THE

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THE GOVERNMENT SCHEMES TO RELIEVE UNEMPLOYMENT.

THE proposals which have been put forward by the new Government for the execution of public works of great importance and magnitude, with a view to the immediate relief of unemployment, have been received with interest by the whole industrial world, and by no section more attentively than by the electrical industries. There is enormous scope for development in various undertakings which are intimately associated with electrical engineering, "the handmaid of all other industries," and any extension of industrial activity is bound to react immediately and favourably upon the output of electrical workshops.

Most prominent amongst these projects is the electrification of railways, of which so much has been heard and so little has been done during the four years which have elapsed since the Armistice. It was dealt with in the Electricity (Supply) Acts of 1919 and 1922, and is an important feature of the policy of the Ministry of Transport. Progress has been hindered by the operations of the Ministry in connection with the reorganisation of the railway systems and the uncertainty which has prevailed regarding the future, but the grouping of the railways has now been established on a definite basis, and the only remaining obstacle is the all-important question of finance. To some extent that difficulty was relieved by the enactment of the Trade Facilities Act, which has enabled the London Underground Railways to embark on new developments of considerable magnitude, and the South-Eastern & Chatham Company to put in hand a scheme for the electrification of its suburban system which will cost over five millions sterling. But a vast amount of work remains to be done.

As Sir Philip Dawson remarked in our issue of November 17th, the electrification schemes which have been carried out in this country up to the present have not only proved of great benefit to the travelling public, but also have been most satisfactory to the shareholders; even at present prices, the electrification of the South-Eastern, Brighton, and Great Eastern systems would result in a substantial return on the capital outlay, besides assisting in the supply of cheaper electricity for all purposes. These schemes are already drawn up, and had they been carried into effect would have provided an immense amount of employment for various branches of the engineering industry; and the plans for several other projects are well advanced, particularly the electrification of the North-Eastern main line from York to Newcastle.

What was imperatively needed was an initial impulse to set this great work in motion, and we heartily welcome the action of the Cabinet Committee on Unemployment in conferring with the managers of the railways with a view to making an early start. Elsewhere we give a list of schemes which are in contemplation. We were glad to learn that the representatives of the railway companies expressed their desire to assist in every way possible, and to push on with development schemes with a view to providing employment at an early date.

It has been estimated that the aggregate cost of the projects in contemplation will amount to sixty millions.

If any difficulty is experienced in raising the capital—surely an improbable event—the Government will guarantee the interest. Power is already given by the Trade Facilities Act for this purpose up to a total of £26,000,000, and if necessary further powers will be obtained; but the method does not involve any actual outlay by the Government, except under very remote circumstances. The matter is rightly being treated as one of urgency.

We trust that the speedy inauguration of these great undertakings will have effect, not only in directly employing a large number of men, but also in stimulating the revival of trade and industry in other directions. The reports that we receive regarding the situation almost invariably indicate that a slow but steady improvement is taking place; important orders have been received from the Dominions, and confidence in the future, which is so necessary to industrial progress, is growing. Out of the mists and shadows of the present we look forward to a future when the sun of prosperity shall shine again upon these islands, and every man shall be assured of steady and remunerative employment.

Trade with Russia.

Under the title of "The Truth About Trade with Russia," a reproduction of a letter from a German correspondent, apparently at Petrograd or Moscow, appears in the *Elektro-Export Anzeiger* of October 15th.

After referring to the high cost of commodities in general, reckoned in paper roubles, the correspondent states that there are no longer to be found any dealers in the iron and the tool trade branches, and the procuring of merchandise from abroad seems not to have been resumed. None of the firms which existed before the war and had a large turnover with German manufacturers are still in business, but some of the owners are occupying themselves with all kinds of commission transactions and are waiting in the hope that other countries will some time come to their assistance in order to be able to carry on again.

The words "free trade" are declared by the correspondent to represent merely a Russian term, as all exports are a monopoly of the Government, although, according to a recent decree, individuals can obtain goods from abroad on securing special permission to do so. But the chief buying remains in the hands of the Commissariat for Foreign Trade. Every step taken, apparently, by those who seek to get an import permit, has to be paid for in the sense of the bribing of the officials. The writer lays emphasis upon this question of bribery, but his letter was no doubt dispatched before the recent decision of some of the Soviet chiefs to take steps to prevent this abuse of official positions.

The correspondent further states that very few foreign firms accept the risk of sending goods to Russia on consignment, as it is feared that the merchandise would be stolen before reaching its destination, and as there are no merchants engaged in regular business, who would undertake the responsibility for payment? Some German manufacturers are said still to imagine that it is only necessary to have a representative in Russia in order to be able to do business as in former times, but the grant of a commission on transactions would by no means suffice to maintain a representative in present expensive times and when bribery is rampant.

It is obvious that the German correspondent is under a misunderstanding in regard to the matter of free trade in Russia. This facility has not existed for a long time past in relation to the export trade, but freedom of trading was thrown open in the inland market some time ago. According to Russian news which reached Paris last week, it is now proposed to abolish even this privilege owing to the prices of commodities having been forced up by about 100 per cent. recently in consequence of profiteering.

From New Zealand to Canada.

Canada is very much before the mind of electrical men at present, and rightly so. Our recent leading article on the possibilities of the market and new measures that were being adopted to increase the sales of British electrical goods, excited so much interest and brought so many inquiries for further information, that it is amply proved that British manufacturers are far from giving the market up as a hopeless one. This is especially encouraging just now by reason of changes which are reported to be imminent in connection with the appointment of some of His Majesty's Trade Commissioners. Mr. G. T. Milne, who has been acting as Chief Commissioner in Canada for some years, is retiring, his period of office having come to an end. That being so, we may, while referring with satisfaction to the service that he has rendered, also refer with pleasure to the recent announcement that he is to be followed by Mr. R. W. Dalton, H.M. Trade Commissioner for New Zealand, who is now in this country laying before such electrical and other traders as are taking the trouble to inquire of him, particulars of the position in New Zealand as it was when he left it a month or two ago. The notes that we published last week from the pen of Mr. Dalton showed that he has no mean ability in grasping and handling an electrical situation. To many of our readers, as to ourselves, this was not unknown many years ago, for Mr. Dalton came into close touch with the electrical fraternity here before he left for New Zealand six years ago. His previously-obtained electrical experience and acquaintance with Governmental policy and procedure, also his knowledge of business-men's ambitions and characteristics, are now reinforced by six years' experience in New Zealand when electrical schemes have been in the forefront of affairs. He will shortly proceed to a vast field of electrical opportunities—Canada—which was written of so hopefully by a number of contributors to our Jubilee issue. We are not suggesting that the chief Trade Commissioner in Canada can hope for a bed of roses, but if we could feel that Mr. Dalton would be able to achieve there one tithe of the success that has marked his lengthened stay in New Zealand, we should say that the British electrical industry's share of Canadian electrical development would be large. The appointment naturally arises: Who is to follow him in New Zealand so that the good work already begun may be continued?

Falling Prices and Swedish Railway Electrification.

It was originally estimated that the expenditure on the proposed conversion to electric traction of the Stockholm-Gothenburg railway would amount to 105,000,000 kronen. As a result of the fall in prices, the estimate was reduced to 50,000,000 kr. last spring, while now the computation has been further lowered to 35,000,000 kr. One of the State Railway officials emphasises the necessity for providing the native firms with work, and states that 20 per cent. of the orders would devolve upon the electrical works and the balance on the copper and steel works and the mechanical engineering works.

German Failure in Foreign Markets.

According to a German newspaper, the competitive capacity of German industry in the world's markets is further decreasing. Thus the Government of Brazil is said to have allocated to a United States firm the order for the delivery of plant for the introduction of electrical working on the Central Railway of Brazil. It is stated that the German offers put in did not receive favourable consideration owing to the prices being higher than those of American firms, and also because it appeared to the Government that the maintenance of the periods of delivery was not sufficiently guaranteed in consequence of the economic conditions in Germany.

There is little doubt that Germany in her efforts to resume trading operations with various markets will

avail herself of the services of men of other nationalities. Evidence to that effect is constantly arising, and it is not surprising to those of us who knew with what measure of success such arrangements operated in this country and in some of our Colonies before the war when the German had less need to hide his face on account of his bloody record, than he has to-day. A revival of such activities was the openly avowed, almost boasted, intention of some, and it was well known what we might expect from them when they felt that British recollections of some things were becoming dulled by the persistence of other problems. But Germany's difficulties in foreign markets are by no means confined to the continued antipathy of other peoples. Financial and economic problems are her supreme trials, and in this connection it is noteworthy that British assistance is to be enlisted to enable German concerns to exploit concessions in Russia. German Press reports have it that an agreement has been reached between Krupps and a British syndicate (Mr. Urquhart is said to have acted as an intermediary) for the exploitation of concessions which have been obtained by the former in various parts of the world, including Russia. It is even said that "the British group" is to advance 75 per cent. of the requisite capital. In the absence of fuller details we are unable to express ourselves very definitely in regard to the reported understanding, but while we want to see industrial and other development taking place which shall secure stabilisation in Russia, and while we want to see an improvement in Central European conditions in the interests of the whole world, we are not enamoured of a proposition that British capital should enable German concerns to secure Russian contracts for execution in Germany. We are at the present moment more anxious that British capital should be available for enabling our own schemes here and in the Colonies to be proceeded with, making employment for our own kith and kin who, in too many cases, perforce stand begging at our very doors.

The Trade Problem of India.

During the past year or two there has been a good deal of fear regarding the future of British trade with India. That country suffered severely from the failure of international demand for her produce and from the over-importation of manufactures, both of which occurred after the Armistice was signed. British merchants were subjected to unwarranted criticism because they naturally refused to shoulder the whole burden of repudiated contracts when delivery could not be taken and payment could not be obtained on speculative orders. Forgetful of the debt which India owes to British capital and energy in developing her economic resources, political and racial feeling there, accompanied by attempts at boycott, at one time threatened the cordial and long-standing relationships that existed with United Kingdom firms. Further, India has shown an inclination to follow the example of so many of our overseas markets and raise a tariff wall against imports in the hope of fostering more manufacture within her own boundaries. It is true that the import duties so far imposed are in few instances heavy, and that the Fiscal Commission, whose report has recently been published, recommends that "discrimination" be exercised in any protective tariff that may be framed. But there is at the same time revealed a strong minority in favour of heavy protectionist duties. In all these circumstances, while one may fervently hope for a full realisation of the measure of optimism displayed in H.M. Trade Commissioner's report, which we summarise in another column, one cannot help feeling that the situation is still fraught with some danger. Our engineering trades, however, have probably less to fear than our textile exporters. If India decides on a policy of protected industrialisation, she will require large quantities of machinery, factory equipment, and semi-manufactured material for many years to come. By way of normal development, Mr. Ainscough anticipates a great expansion in the demand for plant of all kinds. A number of sound industrial propositions are, he says, merely awaiting a favourable money market before they are floated. He looks forward, too, to British success in obtaining the bulk of the orders placed in connection with the expenditure of £100,000,000 which is to be made during the next five years on the Indian railways. In this connection our engineers might do well to note the Trade Commissioner's remarks about American preparedness.

International Telephony.

The French Minister of Posts, Telegraphs, and Telephones (M. Paul Laffont) proposes, according to the Paris correspondent of *The Times*, to invite the technical administrators of the telephone systems of the Western European countries and of the Mediterranean seaboard to attend a conference at Paris in the near future, with a view to the establishment on a commercial basis of a practical system of long-distance telephony by means of international trunk lines.

The delegates to this international technical conference shall include, it is proposed, representatives of the telephone systems of 13 countries—namely, England, Belgium, Holland, France, Switzerland, Italy, Spain, Portugal, Morocco, Algeria, Tunis, Tripoli, and Egypt—and M. Laffont urges that France, by her geographical position, would naturally become the keystone of the vast telephone system that would be formed by the combination of the systems in the above-mentioned countries. If France does not become the intermediary, Germany, it is feared, will try to take her place.

In outlining his plan, the Minister calls attention to Mr. Frank Gill's recent presidential address before the Institution of Electrical Engineers, which we commented upon at the time, in which the long-distance telephone service that is available in the U.S.A. was instanced as a striking example of what is possible as a regular and practical system. Mr. Gill's bold plan, it will be remembered, is that Europe should, in effect, be treated as one country for telephonic purposes.

His additional suggestion—that a conference of representatives of all the European telephone authorities should be called immediately—seems to have been acted upon, and if the Conference can get to work without undue delay, it should find no great difficulty in formulating a scheme for the attainment of the desired result, which could be submitted to the International Conference on Electrical Communication, which, it is expected, will take place in Paris in the spring of 1923, when an attempt will be made to come to agreement on the various subjects that were discussed at the preliminary conference held at Washington in October and November, 1920.

Mr. Gill's daring plan seems to have been approved of, at any rate in France; America has found the telephone service indispensable to the efficient transaction of commercial affairs, and there would appear to be no serious reason why Europe should not share that convenience also. As Mr. Gill stated in his address, the language question presents no difficulty, and the better the facilities for intercommunication the better for the peace of the world.

International Arbitration in Commercial Disputes.

With further reference to this subject, upon which we have on several occasions commented editorially, we learn that the Executive Committee of the International Chamber of Commerce, which assembled in Paris last week, decided that merchants and manufacturers in all countries should have the facility of utilising the services of the Court of Arbitration which has been established in connection with the Chamber. The Executive Committee of the Court is ready to examine any disputes which may be submitted as from the present time. The solemn inauguration of the Court, comprising 100 members representing the affiliated countries, will take place in Paris on January 19th, 1923.

CAUSES OF TRANSFORMER FAILURES.

By S. AUSTEN STIGANT, A.M.I.E.E., M.Am.I.E.E.

The faults that most frequently occur in practice may be classified broadly as follows, although to a large extent the different kinds often react upon one another:—

A. Breakdowns in the magnetic circuit, *i.e.*, in the cores, yokes, and adjacent clamping structure.

B. Breakdowns in the electrical conducting circuit, *i.e.*, in the coils and minor insulation and terminal gear.

C. Breakdowns in the dielectric circuit, *i.e.*, in the oil and major insulation.

D. Other structural breakdowns.

These breakdowns may be due (*a*) to faulty manufacture, which comprises poor design, faulty material, and bad workmanship; and (*b*) to faulty and abnormal operation, which includes careless drying out and installation, lack of adequate supervision, and abnormal transient or sustained operating conditions. How far these various factors are responsible for transformer breakdowns can be judged from the following review.

(A)—Breakdowns in the Magnetic Circuit.

1. Failure of core bolt insulation, paper or other insulation between laminations and insulation between yokes and yoke clamping plates. These failures produce large circulating eddy currents which generate considerable quantities of heat, so damaging the core and possibly the coil insulation.

2. Vibration of the core structure due to slack core clamping bolts. This tends to weaken all the core insulation, which produces the failures mentioned under 1.

3. In manufacture, the edges of the core and yoke laminations may have become burred due to the continued use of worn dies. Laminations become short circuited therefore, and eddy currents with consequent abnormal heating are produced.

4. Similar to 3 is the presence of iron filings or small steel turnings between the laminations; the results, too, are frequently the same.

5. Abnormal gaps, between the cores and yokes of transformers with butt yokes, may be left due to poor machining. In service this produces local heating and possible burning in the vicinity of the gaps.

6. Shallowly designed yokes, particularly of the "butt" type, result in the magnetic flux entering and leaving the cores at an angle other than normal to the joint. This produces local eddy currents and heating at the joints. A deep yoke eliminates this by drawing the flux more vertically upwards or downwards, so tending to bring the leaving or entering angle back to the normal.

7. High core loss and excessive heating of the core is produced when the e.m.f. waves, for a given effective voltage, are flat topped. The formula connecting voltage and flux is—

$$E_{eff.} = 4 \cdot f \cdot B_{max.} \cdot A \cdot n \cdot T \cdot 10^{-8}$$

where f is the form factor of the e.m.f. wave.

For a sine wave of e.m.f., $f = 1.11$;

For a peaked e.m.f. wave $f > 1.11$, and therefore $B_{max.}$ is lower for the same effective voltage, and the iron loss is less than if the e.m.f. wave were sine shaped.

For a flat topped e.m.f. wave $f < 1.11$, and therefore B_{max} is higher for the same effective voltage, and the iron loss is greater than if the e.m.f. wave were sine shaped. The magnetising current is also considerably heavier.

8. Apart from the increased difficulties of core assembly, the use of thin laminations often produces high iron losses and heavy magnetising currents. This is on account of the low iron factor involved, which gives a smaller cross-sectional area of core than has been allowed for, and a correspondingly higher value of $B_{max.}$ This cause only applies to those cases where the shops have inadvertently used thinner laminations than they have been instructed to use by the designer.

9. High saturation of the magnetic circuit often results in heavy magnetising current rushes occurring when switching a transformer into circuit on no load. While this current rush generally dies down rapidly, large electromagnetic forces are generated while the heavy current lasts, and the windings are thereby strained. The phenomenon becomes more severe the nearer the transformer is located to the generating source. Repeated switching-in may ultimately cause disrupture of the windings.

10. If transformers providing a mid-wire or neutral for use as a d.c. neutral have not their windings carefully balanced, the d.c. ampere turns in the windings on opposite sides of the transformer neutral do not neutralise one another. The a.c. flux, therefore, instead of being symmetrically disposed on either side of the normal *zero* axis, becomes equally disposed on either side of an axis corresponding in value to the resultant d.c. flux in the core. That is, the a.c. flux becomes superposed upon the resultant d.c. flux, and the total a.c. flux waves are unsymmetrical about the *zero* axis. Therefore, the core becomes highly saturated during one half period and correspondingly less magnetised in the next half period, and it heats up to an extent depending upon the value of the d.c. resultant flux.

11. Transformers for use with rotary converters are often designed for a high internal reactance for the purpose of d.c. pressure regulation. The high reactance is obtained by the use of magnetic shunts placed in the leakage field between the primary and secondary windings, and if these shunts are designed to possess a high degree of magnetic saturation, a large amount of heat will be generated, which will eventually destroy the coil insulation, and possibly cause the oil to sludge. Under certain operating conditions, the high saturation in the magnetic shunts may produce commutation troubles in the rotary converter, due to the higher harmonics introduced.

12. High saturation in the magnetic circuit produces higher harmonics of voltage or current of appreciable magnitudes which may have very serious effects. Generally the third harmonic only is of importance, though under very abnormal conditions harmonics above the third may create trouble. Third harmonics of magnitudes likely to be objectionable are confined to three-phase shell-type transformers, and to three-phase banks of single-phase core and shell type transformers; they are usually negligible in three-phase core type transformers. Their sphere of potency can still further be confined to the star/star, star/interconnected star or interconnected star/star connections; in the last two connections the star side only need be considered. With isolated neutrals, the line to neutral voltage will contain a large third harmonic component equal in maximum amplitude to 60 per cent. or more of that of the fundamental. This represents an increased dielectric stress on the coil insulation which *may* shorten the life of the transformer. If the secondary neutral only of a star/star connected transformer or bank supplying a high or moderately high voltage cable is earthed, the third harmonic component of the magnetic flux becomes amplified, which further increases the third harmonic voltage component until the transformer core becomes thoroughly saturated. The saturation, therefore, reaches a much higher value even than originally designed for, and the iron loss increases considerably.* Under such conditions the transformer will reach a dangerous temperature, which will cause deterioration of the coil and core insulation, and if allowed to continue will produce

* See "Triple Harmonics in Transformers," by G. Faccioli, *Journal* American I.E.E., May, 1922.

sludging of the oil. This abnormal heating occurs without load on the transformer, and in practice the iron loss has been known to increase to three times the normal.

13. If the voltage applied to a transformer must be increased appreciably on account of the exigencies of the system load, the frequency must also be increased in order to avoid high magnetic saturation of the core. An *increase* of voltage must not be accompanied by a *decrease* of frequency, as, if it is, high core saturation will occur with resultant increased iron loss and abnormal core heating. The interdependence of voltage, frequency and flux will easily be seen from the following formula:—

$$B_{max.} = E_{eff.} \times 10^8 / 4 . f . A . T . n$$

where $B_{max.}$ = max. induction density in the core.
$E_{eff.}$ = effective applied voltage,
f = form factor.
A = cross-sectional area of core.
T = number of turns.
n = frequency.

14. In the older manufactures, ageing of the core plates may be found to have taken place. This is due to a deterioration of the material of the laminations, and the result is manifested by a considerable increase in iron loss and rise in temperature of the transformer. This may eventually lead to a partial or complete destruction of the coil insulation and to sludging of the oil.

(B)—Breakdowns in the Electric Circuit.

1. A short circuit between adjacent turns of a coil—usually of the h.p. winding—may be caused by the presence of sharp edges on the copper conductors. If the transformer vibrates when on load, or if the windings are subjected to repeated electromagnetic shocks, these sharp edges will cut through the insulation and allow adjacent turns to make metallic contact.

2. A short circuit between turns may result from the dislodging of one or more turns of a coil caused by a heavy external short circuit across the windings. Breakdown may not occur immediately the turns are displaced, but should the transformer vibrate while on load due to looseness of core bolts, or should it receive repeated heavy electromagnetic shocks, abrasion of the insulation between adjacent dislodged turns will most likely take place, so producing a breakdown.

3. Occasionally the cotton covering of square wire conductors may not be wound on the copper as tightly as it should be, in which case it has a tendency to bulge over each face of the conductor. The true square configuration of the conductor is, therefore, masked, and in fact it may even appear to be more round than square. Consequently the coil winder has some difficulty in making certain that the conductor has not become twisted in the winding process, and cases have occurred where short circuits between turns have arisen as a result of this twisting. At some place in the coil, adjacent conductors are edge to edge or face to edge, and in time the insulation between such turns becomes chafed and breakdown ensues. The trouble is, of course, accentuated if the edges of the conductor happen to be sharp instead of rounded.

4. Transformers for use on heavy powered systems are now usually fitted with adjustable coil supports for the purpose of taking up any shrinkage of the insulation which may occur under service conditions. Unless this hand adjustment of the coil supports is performed very carefully by an experienced workman, so as not to place too great a mechanical pressure on the windings, some of the conductors may become dislodged, and a short circuit between turns may occur as outlined under 2 above.

5. Short circuits between turns are almost bound to occur sooner or later should moisture penetrate the fabric insulation of the coils. Breakdown from this cause is rendered more imminent still if the coils have been insufficiently impregnated, *i.e.*, if the varnish has not thoroughly penetrated to the innermost layers of the coils.

6. Drying out a transformer on site may be undertaken by an engineer not fully conversant with the operation, and the process may be unduly shortened. If normal electrical pressure or a testing pressure is switched on while the insulation resistance of the windings is still low, the insulation between adjacent turns is very liable to fail at some point or other on account of the presence of moisture vapour.

7. Cases have occurred where thin ribbon wires have been wound on edge, direct on to an insulating cylinder, to form spiral type coils. Such a coil is mechanically weak, and the turns are liable to lean over from the plane normal to the cylinder surface so that the coil becomes very susceptible to damage in the event of an external short circuit occurring on the system.

8. In very high voltage transformers the conductor insulation may deteriorate on account of the corona which may take place from sharp or slightly rounded edges. This phenomenon becomes more acute should there be any occluded air in the coils, and a short circuit between turns may eventually take place.

9. If a transformer is subjected to more or less rapidly fluctuating loads, the expansion and contraction of the copper conductors alternately compresses and releases the pressure on the insulation between turns. As the dielectric strength of most fabric insulations decreases with increasing mechanical pressure, the windings become more susceptible to failure should they be subjected to electrical or magnetic shocks.

10. If individual coils, particularly of the h.p. "cross-over" type, are designed to have too great a radial depth in comparison with their height, so-called "hot spots" will arise in the interior of the coils. These will produce brittleness of the conductor insulation, and a short circuit between turns may eventually take place. This danger becomes considerably enhanced if the design of the oil circulation system is inadequate, *i.e.*, if the oil ducts are too narrow.

11. For the purpose of increasing the dielectric strength between adjacent conductors, the latter are often taped with one or more overlapping layers of insulating tape. If this has been carelessly carried out, only one effective thickness of tape per layer instead of two may be the result; that is, the overlapping has been converted into a butt joint of the taping. Pressure tests on a sample coil would, of course, locate this, but otherwise the windings would probably fail sooner or later when subjected to the shock of electrical pressure rises.

12. Heavy eddy currents may be produced in coil conductors—usually the l.p. coils—where there are several wires in parallel to form each conductor. These wires are usually rectangular, and they should so be wound that the shorter side of each is presented to the flow of the leakage flux between primary and secondary windings. That is, the shorter side should be normal to the path of the leakage flux and the longer side parallel with it. If this procedure is reversed, excessive eddy currents flow in the conductors, and "hot spots" may be produced in the windings.

The various layers of sub-divided conductors should be transposed during the winding process so that each parallel portion in its path from terminal to terminal occupies each different position for an equal length. This has the effect of equalising the load taken by each individual wire. If this be not done, the different layers will not share the load equally, and some will overheat, thus tending to accentuate the "hot spot" phenomenon previously referred to.

13. Badly soldered joints between coils may overheat on load, and local carbonisation of the oil may occur. The heat generated at the joint will probably be transmitted to a certain contiguous length of conductor of each coil, and this may partially carbonise the insulation round the conductors and eventually result in a short circuit between turns.

14. In very high voltage transformers, dielectric losses in the insulation may lead to excessive heating and ultimate failure of the latter.

(To be concluded.)

ELECTRO-FARMING.—II.

The Load-Factor of the Poultry Farm.

By R. BORLASE MATTHEWS, Wh.Ex., A.M.Inst.C.E., M.I.E.E., F.R.Ae.S.

Where progress is slow, lack of knowledge will be found. This is very true of electro-farming in this country at the present time. Although its advantages have been amply demonstrated abroad and confirmed at home, there is no definite move being made to secure them for this nation. The reason is largely and frankly ignorance of the possibilities and conditions.

Probably the chief cause of farm electricity supply not being developed in this country is the widespread impression that the agricultural load factor is too poor. Fortunately this impression is quite wrong. It is the purpose of this article to examine in reasonable detail the conditions which govern the poultry farm's demand for power, and to show the true value of the resulting load factor. It will be found to be surprisingly good—

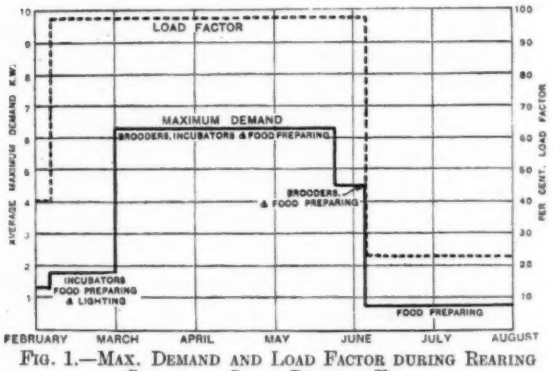


Fig. 1.—Max. Demand and Load Factor during Rearing Season on Small Poultry Farm.

much better, in fact, than any works load factor in industrial areas.

It is fairly obvious that the class of farming carried on should influence the demand for power and modify its load factor. This is found actually to be the case. The dairy farm—as usually carried on in England—is the poorest with its modest load factor of 13 per cent. At the other end of the scale the poultry farm gives at least 50 per cent. In themselves these are desirable loads, but considered in conjunction with the other demands for which power stations usually cater, they have additional attractive features.

It is not pretended that machinery or methods developed for other drives will necessarily give the best results by the mere addition of an electric motor. Although even under those circumstances a considerable improvement will be found, it is possible in farming, as in other industries, to obtain better results where slight adjustments in the usual processes are made to take full advantage of the electric drive.

If a private generating plant is installed, the farmer can usually be induced to make the necessary modifications in his working arrangements if it is made clear to him that by so doing he can meet his requirements with a smaller and cheaper plant. That represents a direct saving to him, and the farmer is essentially an economist, though unfortunately he is seldom considered in that light. If progress is slow in building up a farm load on public mains, it is because few engineers have taken the trouble to put the advantages before him as a question of money value. It is utterly futile to start out with the idea that his load is unremunerative to the station and charge him in consequence a price per unit which makes electricity unattractive, and apparently unremunerative to him. It is a national calamity when this short-sighted policy is pursued, based on a woeful misconception of the facts.

The twenty-four hour load enables the maximum number of units to be supplied per annum from a generating plant of given size. Because its earning capacity is thus increased, the standing charges per unit are reduced, and owing to steady loading and the consequent better use of the generators, more economical running is obtained. The cost per unit is therefore much reduced. Such an elementary statement may appear to be a mere platitude, but it contains a basic principal unfortunately too often ignored when desirable loads a little out of the ordinary are considered. Were it really applied, a more extended development of heat storage water-heaters would have taken place.

Properly organised on electrical lines, the modern farm can provide a load which in combination with the much prized industrial load of the towns will approach reasonably near to the desirable twenty-four hour condition.

In spite of the enormous imports of poultry and eggs into this country, poultry farms on a large scale are numerous and, in general, prosperous. There is no doubt that given cheap current, their number would rapidly increase, for the reduced expenses would enable a part of the twenty millions annually expended on imported poultry products to be spent on home produce. From the central station standpoint, the load provided by a fully electrically-equipped large-scale poultry farm is as close to the ideal as can be obtained in tranquil times when the fever heat of munition-making has subsided. For five or six months of the year a continuous and constant load for twenty-four hours per day and seven days per week can be obtained. A poultry farm upon which the author is advising will require, when electrically equipped, a plant capable of giving 45 kW continuously during five months of the year under these desirable conditions. The remainder of the year will provide a load factor of from 25 per cent. to 30 per cent.

There is no reason why even this very good condition should not be still further increased and incubation made all-the-year-round business in order to supply the demand for table poultry. The introduction of new means will almost certainly lead to new methods.

It will probably be a surprise to many that the somewhat despised "hen farmer" can be such a desirable connection from the supply standpoint. In the case instanced above, the weekly units amounts to 7,500, or,

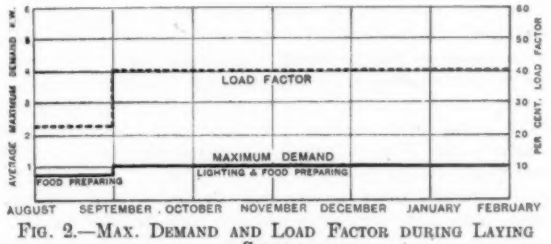


Fig. 2.—Max. Demand and Load Factor during Laying Season.

for the five busy months, 166,000. Even if the remainder of the year brings up the total annual consumption to 200,000 units (a figure much below what the consumption will be), the result is an average annual load factor of 51 per cent. Looked at in another way, this poultry farm will consume as many units annually as an engineering works with 450 h.p. of motors, or a cloth factory with a maximum demand of over 200 kW.

Valuable as such a load would be to any supply station, it is insignificant when compared to the consumptions of the large American poultry businesses whose speciality is the sale of day-old chicks. These concerns run five months in the year and then shut down till the next season. The largest hatchery is entirely

equipped with electrically-heated incubators and has a capacity of about 120,000 chicks per week (say 150,000 eggs). The weekly consumption of electricity is from 50,000 to 80,000 units. The maximum demand is nearly 400 kW—truly a surprising load for a specialised farm.

It is interesting to note that the hatchery referred to has now entirely abandoned oil and gas-heated incubators. The "electrics" were introduced gradually as the business grew, one of the reasons for such growth being the superior vitality of the chicks as compared to those obtained from hatcheries employing the older types of incubators. The author has himself experienced this same demand, and his hatching capacity has been taxed to its utmost capacity to supply the combined needs of his own farm and the requirements of his neighbours. There is no reason why hatcheries should not be established close to towns from which they could obtain their electricity. Electric hatcheries of the kind referred to above would be a new development for this country and one which would benefit the farmer and the supply authority alike.

Although the incubator load is so very attractive, the brooder or foster-mother load associated with it is equally valuable, and gives a 70 per cent. or 80 per cent. load factor. Moreover, it usually continues two or three weeks after the incubator season is over. The farmer who has used electricity so successfully for rearing will continue to use it for power purposes for the remaining months of the year, and although the maximum demand will be lower, there is no reason why the load factor should drop below 20 per cent. Poultrymen to-day buy a large quantity of feeding stuffs, meals, &c., which they could grind and mix themselves with great advantage, especially from a financial viewpoint. The electric motor provides the means whereby they can do this, the work providing a fairly steady load for five or six hours per day.

The modern laying house is not complete without electric light, which has been shown to stimulate the production of winter eggs (*i.e.*, the eggs which bring the greater return). This load provides from 500 to 800 hours' consumption per annum with a maximum demand of about one kilowatt per 1,000 birds. The load comes on in the early morning until dawn, and also from dusk till seven or eight o'clock in the evening. This load is comparable with shop lighting, and is certainly a better load than that of the ordinary residence. Yet the latter is considered a desirable prospect while the poultry farm is neglected, though its possibilities are vastly greater.

The accompanying diagrams have been drawn from actual data to illustrate the nature of the demand created by a suitably electrified poultry farm of moderate dimensions such as is common in England. As explained above, the load factor varies, being much greater in winter than in summer. This will be seen from the load-factor curve shown in the diagrams.

The present time is the most favourable moment for supply authorities to commence a real campaign to get poultry farms connected. If the work is properly handled there is sufficient time to have the installations completed in time for the next incubating season.

HYDRO-ELECTRIC POWER DEVELOPMENT.

By WILLIAM T. TAYLOR, M.Inst.C.E., M.I.E.E.

Hydro-electric systems are generally located a long distance from load centres and connected to overhead long-distance high-voltage power transmission lines. Hence they are not, broadly speaking, so reliable as steam power plants situated close to the load centres.

Although water power can never be exhausted by use, because it comes from the total precipitation in the form of rain water, &c., which runs back into the streams and rivers, the amount available *in any one year* has definite limits. This amount varies in quantity from year to year. The amount of water power which can be expected, the total cost of the development, and the possibilities of disposing of the power, &c., all are problems for the engineer. Of all the studies to be made, perhaps the most important one is a good and safe determination of the stream flow and storage for the most economical development. Field examinations are usually necessary, and in some cases the lack of available information may justify extensive hydrographic and topographic surveys. Unfortunately, the cost of these investigations must usually be kept down to a minimum, which often precludes the making of detailed examinations and surveys. In some countries the engineer can obtain a fair amount of the necessary information by consulting government records, reports, &c.

The principal fundamental requirements for a good project are: (1) Good annual rainfall; (2) large catchment area; (3) substantial fall within reasonably short distance; (4) large areas for impounding flood waters; (5) good foundation material for a small dam to hold the floods; (6) low value of land; (7) reasonably low cost of the development; (8) adequate market for power within a moderate distance; (9) reasonably good price for electrical energy; (10) reasonably low total annual expenditures covering complete operation of the development; and (11) reasonably cheap terms upon which money is obtained for the development. When a project involves all of the fundamental considerations in the advantageous manner mentioned, the success of the development is well assured.

The rate of advance and the magnitude thereof will depend, to a large extent, on the financial aspects of complete generating stations, the excessive cost of energy at the receiving end of the line, and reliability of the generating stations and line—with particular reference to generation and transmission of hydro-electric power. As engineers, fully alive to all and every phase of hydro-electric power transmission engineering, our duty should be the protection of the public. Take only one case, of which we can find many examples in other countries, and which, in the original stage, is alterable and controllable if, for instance, the Electricity Commissioners are given every facility and help to ascertain the facts. Assume, for example, a certain water power and transmission system is put forward; the studies, reports, &c. (in the form of documents, maps, photographs, and the like), are placed before the Electricity Commissioners, who pass upon them, perhaps without personal knowledge or without an independent report thereon. An exclusive licence or concession is finally granted for a 25-year or longer period, on the basis of the said documents, &c., appearing to be satisfactory. The company or licensee places before the public a certain prospectus, &c., of a very attractive nature, with the result that the required amount of capital is subscribed in a very short time. The hydro-electric works and the most important power transmission sections are constructed. The receiving stations are built, and, let us say, electrical energy in bulk is sold at a price about equal to the cost of generation. After a lapse of time it becomes known that, whereas costly storage and regulating reservoirs were built for and on the basis of a given h.p. capacity in water power, only, say, 50 per cent. is actually available when taken as the best water-year development capacity, *i.e.*, highest flow, *plus* storage for an average year on the usual estimated basis.

After a lapse of, say, seven years, commencing from about the time the licensee began to raise capital, the public are looking for some return on the investment. At or about the same time the licensee is perhaps looking for more money on the pretence of, or (which is more likely) for the purpose of, building necessary steam-power stations and, perhaps, transmission lines. It is obvious that this country must not have any of these very bad examples of "commercial" hydro-electric power transmission engineering if the industry is to expand. It would be due to such failures or "fishy" commercial engineering that financiers and the public alike would be apt to say: dispense with power transmission, put up the steam plant first, and then talk about water power and transmission lines and the power market, &c., when more reliable information regarding the available water power, reliability of service, and favourable power rates, &c., is at hand. This represents one of the conditions this country will have to guard against, and, in the writer's opinion, every assistance should be given to the Electricity Commissioners.

In general, developments of the type offering in this country are likely to require a relatively large capital investment, and the return on these investments will depend in no small measure on how the plants obtain the *greatest number of kW-hours per cubic ft. of water*, and on how the plants are burdened by the terms of and expense of capital for the development. For this country, hydro-electric plants will, in general, be supplemented by steam plants, in which case all the load that cannot be supplied by the hydro-electric plants must be obtained by burning fuel.

Putting aside for the moment the question of the most economical development, future progress in the way of storage (excess and ordinary) is certain to attach considerable importance to the saving of fuel and operating expenses, &c., during that part of the year when the stream flow is high and when, perhaps, it would otherwise go to waste; obviously, the existence of *secondary power* will permit the closing down of an equivalent amount of steam power. Depending on the character of the development, but more particularly on the amount of storage available, secondary power may, in one way, be determined by such a condition as the economic balance between the yearly fixed and operating costs of the additional hydraulic and electrical plant, equipment, &c., and the operating expenses necessary with a steam plant of equivalent capacity. The "base-water" or *primary power* usually means the amount available for 8,760 hours in the year. When storage is used, the estimated available power is most often taken over every hour of every day for 100 to 150 days of the year, the period of time varying with the amount of storage and the probable use of the power, the load factor, the diversity factor, &c. The extent to which storage can be used to augment, equalise, or regulate steam flow depends on a great variety of conditions varying widely in character. In this country the amount of energy that can be delivered in the form of secondary power is likely to be much greater than the amount that can be delivered as primary power. For many of the larger future developments in this country, the secondary power can be fully utilised only by combination with some other power, such as steam-electric or other hydro-electric plants. In most cases, the *excess* storage of water can be accepted as representing primary power—difficulty may often be found in the determination of the exact dividing line for these two distinct classes of water power. In all cases, the chief question will be the determination of the amount of plant and apparatus that should be installed for a given development using storage, and how much it will cost to develop this class of power in comparison with what is usually expressed as the relatively more reliable source—steam-electric power.

It is clear that, failing to obtain a reliable analysis of the rainfall and run-off or the accurate determination of the quantity and distribution of the stream flow available, it will be impossible to prepare final figures for the most essential matters, such as: the most economical development; the maximum and uniform power which can be depended upon at all times in all years; the length of time storage or secondary power will be available; the actual (*not* the estimated) total energy available corresponding to (*a*) base-water supply, and (*b*) storage. Furthermore, as regards *the economical plant capacity* which depends chiefly on the average annual run-off of stream flow, other important matters are involved, such as: whether the plant is to be operated singly or to be linked up with other hydro-electric or steam-electric plants; the system load factors and their characteristics; the anticipated power market (present and future); the total development costs; the estimated profits, &c. All these and other independent and inter-dependent factors must be given proper study.

In the hydro-electric field we have now reached a stage of high efficiency where hydro-electric works and plants can be cheaply installed, cheaply maintained, cheaply housed, and cheaply operated. Due to the present state of *high overall efficiency* of the developed waterways, turbines, generators, transformers, transmission lines, &c., constituting all the main "links" in the developed hydro-electric system (of which the turbine has up to the present received perhaps the most attention, due chiefly to its relatively delayed state of high efficiency), the writer is firmly of the opinion that, now the turbine has reached about the highest efficiency (94 per cent.) that can be expected of it, and that hydro-electric power in great amount has been delivered to the switchboard at 90 per cent. overall efficiency, the near future will see a more general concentrated attention on those matters affecting improvement in the "*overall water efficiency*," commencing with the catchment area itself and following every movement of the rain water up to and including storage and water supply to the developed waterways. As shown below, present-day maximum efficiency of the developed works, plant and apparatus, &c., clearly indicates that little improvement can be expected in this direction. With proper attention given to conservation of water and head effected by the reduction of hydraulic losses to a minimum, and by refinements in the design of the various essential elements of the development as a whole (starting at the watershed itself), the production of power is certain to reach a much higher state of perfection, speaking generally, than exists in the world at the present time.

From a universal viewpoint, very few hydro-electric schemes can claim (*a*) the highest possible practical use of a given quantity of rain-water; (*b*) the best and most economical location of development sites; (*c*) the most economical development as a whole; and (*d*) the very best and most economical system operating conditions. In general (considering the *developed* hydro-electric system) there are to be found several outstanding points in a complete development where efficiency improvement can be effected. The principal points, considered in the order of importance as regards losses, are: (1) conservation of rain-water from the time of rainfall up to and including the point of storage and the entrance through racks at the intake of the developed waterways; also the accurate determination of the economical development with reference to the available water power; (2) turbines complete; (3) transmission lines; (4) feeders; (5) electric distribution service; and (6) the open conduit (unlined) and the pipe line.

One of the greatest mistakes of the present day is in the high value assumed for overall efficiency of the complete hydro-electric development. Usually the lowest overall efficiency given is somewhere around 65 per cent., whereas 45 per cent. would—with the majority of existing developments—have been nearer the mark when accounting for all losses from and including the developed waterways up to and including the point where the energy is to be sold, *i.e.*, the customers' service. Neglecting the losses in advance of and above the entrance to the developed waterways, the overall efficiencies of the *best* and *largest* hydro-electric systems,

as also the overall efficiencies of future similar or larger-sized developments, are given below in estimated form.

Certainly the most important problem of the future will be one of how efficiently water can be utilised rather than one of producing a reliable source of power, which latter we have already overcome. Higher efficiency will come from the study and training of run-off, &c., and from the making of the development as a whole—commencing at the watershed; that is, by conservation and economical utilisation of the seasonal flow to the very best advantage and by getting as much of the total precipitation, in the form of run-off water, to the turbines with the *minimum of loss of water and head*. In other words, to obtain the greatest number of kW-hours out of the smallest quantity of water, or the greatest number of kW-hours from the highest possible ratio value of run-off to total precipitation.

For the best *modern* and best *future* hydro-electric systems (large systems only), the overall losses respectively, should come within the prescribed ranges (*a*) (*b*) and (*a'*) (*b'*) given in the following:—

*Hydro-electric system losses.**	Per cent. values. Best Modern. (*a*)	(*b*)	Best Future. (*a'*)	(*b'*)
No. 1. In the developed waterways, including head works, short conduit and pipe line, &c.	2	4	1.5	2.5
2. Turbines (main units, exciter units, &c.)	7	10	6	10
3. Generators and exciters, &c. ...	3	3	1.5	2.5
4. Step-up transformers	.8	1.5	.7	1.0
5. Transmission lines	6	8	4	6
6. Step-down transformers ...	.8	1.5	.7	1.0
7. Synchronous machines, sub-stations, and distribution centres	4	8	4	6
8. Feeder circuits	5	10	5	9
9. Low-pressure transformers and distribution service	5	9	4	7
Total	33.6%	55%	27.4%	45%

The best overall efficiency of all the developed waterways from the headworks-intake to the turbine shaft (including such rare cases as the late Niagara installation) is:—

Best modern (*a*) 91 per cent. *Future* (*a'*) 92.5 per cent.
(*b*) 86 per cent. (*b'*) 87.5 per cent.
(*mean value*) 88.5% (*mean value*) 90%

As bulk supply will usually include those items between No. 1 and No. 6 inclusive, the very best overall efficiency will be:—

Best modern (*a*) 81.4 per cent. *Future* (*a'*) 85.6 per cent.
(*b*) 72.0 per cent. (*b'*) 77.0 per cent.
Best mean overall efficiency 76.7% (modern).
Best mean overall efficiency 81.3% (future).

But, to the point of energy for sale to low-pressure customers, the best overall efficiency will be around the following figures:—

Best modern (*a*) 66.4 per cent. *Future* (*a'*) 72.6 per cent.
(*b*) 45.0 per cent. (*b'*) 55.0 per cent.

With a best mean overall efficiency of 55.7% for *the most modern and largest sizes, and a best mean overall efficiency of* 63.8% for *the best and largest future systems.*

Two developments are rarely, if ever, exactly alike, hence the limits (*a*) and (*b*), and (*a'*) and (*b'*), are given for what may be called the highest practical range of efficiencies. At the present time the major portion of the world's hydro-electric systems, taken as a whole, have not attained the efficiencies of (*b*); hence the necessity, when making a determination of available power, of allowing for a proper and safe overall efficiency which, at the present time, is usually rated too high. The above values represent the highest range of efficiencies.

* Poor hydro-electric systems have losses somewhere in the order of:—

Item.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.	No. 8.	No. 9
Losses %	11	18	5·5	2·2	15	2·2	12	16	18

It rarely happens that all these losses occur on any one system, hence they are not additive, nevertheless the respective losses given represent poor design, and they are found in practice. On the other hand (*a*) and (*a'*) will be of rare occurrence as they represent the very best efficiencies for each main "link" in the system.

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Society of Technical Engineers.

The E.P.E.A. has figured recently to a considerable extent in the technical Press, and such references naturally occasion some curiosity as to the present standing and activities of its sister organisation—the Society of Technical Engineers. The success of the E.P.E.A., in the sphere where it proposed to function, has not been more clearly denoted than by the attempt to clip its wings, in the matter of alteration of status of some of its members. The S.T.E. has apparently not yet achieved any recognition by the "powers that be," and has therefore no body to be kicked, but its official non-existence is a very doubtful benefit to members and possible members. It is also, I believe, unknown to a very large number of potential members, and by a few who have heard a little about it, it is described as a "wash-out," and judging by the paucity of Press references, both counts appear to possess a certain semblance of truth. Wherein lie the reasons for the undoubted and distinct success of the E.P.E.A. and the apparent failure of the S.T.E.? The latter body, it will be remembered, was heralded and commenced its career in the midst of publicity and propaganda, an environment which was certainly not the good fortune of the E.P.E.A., and yet with this undoubted advantage over the E.P.E.A. although the publicity rapidly became a vanishing quantity, it appears to have made little or no headway, is now apparently moribund, and if rumour is correct, likely to dwindle away into a vague regret. The E.P.E.A. gives every promise of fully justifying its "raison d'être," but the S.T.E. with a larger field for membership, more favourable conditions for propaganda, and with only slightly less time to develop its policy, has not up to the present indicated that it will ever compare favourably with the E.P.E.A. as a protective organisation. There is surely scope for a live association of technical engineers, and if the S.T.E. does not fulfil requirements, the reason should be ascertained and rectified or alternatively the E.P.E.A. might consider opening its membership to the technical staffs of electrical manufacturing concerns.

One of Them.

November 27th, 1922.

Estimating for Internal Wiring Contracts.

In your issue of the 24th inst., Mr. Kirk adversely criticises "The Scottish Mode for the Measurement of Electrical Works, 1918." We would mention that we have scheduled, estimated, and made out our accounts practically in accordance with this Mode in all the installations we have carried out during the last 30 years, that is, before the system was introduced in the Scottish Mode, and we have never found any difficulty with it in practice.

Lowdon Bros. & Co.

Dundee, *November 27th*, 1922.

The problem of an equitable code for the estimating of internal wiring contracts is much more involved than appears on its surface, and the President of the Electrical Contractors' Association of Scotland has drawn my attention to the letter in your issue of November 24th, by Mr. Alan Kirk, who states a case which might, under certain circumstances, be inequitable.

The code was designed to be applied for work of any voltage, to be issued by an engineer conversant with the principles involved, and to ensure that the contractors estimating would all be tendering for the same amount of work, and the same class of materials.

The classified circuit wiring termed "wiring to points; lighting, plug, switch, &c.," also includes the proportion of leads between the distributing fuseboard and the distribution box, from which the lighting point in question is served, and if the number of lights at any one point is increased it will be necessary for the contractor to rearrange the lighting circuits so that the number of lights thereon shall not exceed the limit mentioned in the specification; the addition of one light could conceivably necessitate running an additional pair of leads between the distributing fuseboard and a local distribution box, involving considerably more expense to the contractor than running an entirely new lead from the distribution box. A case in point would be in a 25-volt installation where the number of standard lamps on any one circuit was four, and this circuit had been filled up before the additional light suggested by Mr. Kirk had been ordered.

The writer's citation of the addition of one light to a three-light point is obviously an intention to quote an extreme case. In most installations the proportion of three-light points, compared with one light, is extremely small, and the addition, therefore, should be a comparison of four lights to one light, and it must be quite clear that a con-

tractor is entitled to twice as much for wiring a four-light point as for one light.

May I remind Mr. Alan Kirk that it costs 1s. to send 5 lb. weight by parcels post, but only 9d. if his package is a fraction of an ounce under that weight.

Basil A. Pilkington.

Edinburgh, *November 27th*, 1922.

Salesmanship.

There is a great deal in your columns in the Electrical Review this week on the matter of Salesmanship, with which I find myself in agreement. May I suggest that salesmanship is first a psychological question: A man must have the gifts and intuition of a seller and must receive the support and encouragement of the management. If after a few months he has it borne in on him that he ought to have done a lot more business, and that the question is why the deuce he has not done so, he loses somewhat in efficiency. There is another attitude of mind very often noticed in "The Management"—that is, that any good contracts were bound to come to that particular company on account of the transcendent virtues of the management and the extraordinary excellence of its manufacture; that also takes off a little more from the salesman's efficiency. Another temptation that "The Management" frequently succumbs to is that of butting in at the last moment and signing the contract with some slight modification, and then saying that "we did it, of course, from this office." That also does not add to the efficiency of the salesman. It should be borne in mind that the good salesman is a highly tempered—but withal a very sensitive—instrument of commerce. It is no use blunting your own tools and expecting work of precision. The management, if it is fit to appoint a salesman, should be taught that selling is a gift of certain temperaments—we, of course, take for granted a good sound technical training and experience of affairs. The salesman should not be taken to be the "outsider" mentally, because he is outside physically. Though I, myself, have had very happy experience as a district engineer, I cannot help thinking that in very many cases the management should have quoted to it: "Physician, heal thyself." That is a quotation which would lead to business—repeat business, which is what "Management" cannot always get and will very seldom get if the salesman is dwarfed in importance to an accident of commercial procedure.

D. P.

London, *November 27th*, 1922.

The E.D.A. is to be congratulated on securing the services of Mr. Wallace Attwood to give his all-too-short series of lectures on salesmanship. I am sure that all of us left Caxton Hall last Friday imbued with a new kind of enthusiasm, *i.e.*, to give better service.

His clear definition of the fundamental points of salesmanship must surely have shown how obvious are our defects.

This type of lecture is bound to do an immense amount of good to those who make a special point of attending the E.D.A. conferences.

W. L. Wernham.

London, *November 20th*, 1922.

Dielectric Loss in Cables.

Referring to the historical note on the above subject in your issue of November 17th, I am now able, through the courtesy of Mr. James Swinburne, to give you the reference to his mention of the subject in connection with the first Deptford 11,000-V paper-insulated main. It is to be found in his paper on "Alternate Current Condensers" which was read before the Physical Society on December 12th, 1890, and published in the *Philosophical Magazine* for February, 1891.

B. Welbourn.

Prescot, Lancs.,
November 27th, 1922.

Steam Condensing Plant.

In reply to Mr. Velut's letter, we would first like to say that we do not wish to bring into this correspondence any personal observations such as those made by Mr. Velut, and we will therefore assume that his experience is all that he affirms.

The matter under discussion is the efficiency of the Delas ejector, and we will confine ourselves to this question.

We note the statement that the reduction in steam consumption of from 20 per cent. to 25 per cent. is based on the results of tests taken by an eminent and independent engineer in this country. Why does not Mr. Velut publish these tests? To do so would inspire confidence. We simply desire to have the statement confirmed, and so far we have not been referred to any condensing plant in this country in reply to the request contained in our previous letter. In this direction we are surprised to hear Mr. Velut state that no comparative result could be obtained. Surely the most valuable test of apparatus is always its performance under operating conditions, and any saving which is real should be obtained under such circumstances. Presumably the condensers to which the Delas ejectors are fitted are of good modern design, and it is not difficult to make a plant reasonably air tight and clean for testing purposes.

We would ask Mr. Velut to reply and state definitely whether he will undertake to supply us as customers with a Delas air ejector which he will guarantee to operate with from 20 per cent. to 25 per cent. less steam than any other ejector. We already have information regarding Delas ejectors tested in France and in the United States, but as we can find no improvement upon the performance of other ejectors, we are anxious to have tests of the Delas ejector as manufactured in this country with regard to which the statement has been made.

Mr. Velut admits that a water jacket was not first disclosed by Delas, and therefore no further remarks on this point are necessary.

H. Fothergill & Co.

London, *November 25th*, 1922.

Literature on "Other Uses."

I have long been hesitating over the question of installing electrical apparatus for other purposes than lighting and have followed the E.D.A. discussions with more than passing interest.

My indecision was brought to a head on Friday morning by the arrival of the sweep, followed later in the day by high words in feminine voices proceeding from the kitchen. In the afternoon I hurried to the showroom of ——Ltd. (across the road) eager to be persuaded. I opened the proceedings by inquiring if they had any literature on the subject of heating and cooking. They had not.

And that closed the proceedings. The door fell softly behind me and I walked slowly away a disappointed and disheartened man.

E. C. R.

London, *November 27th*, 1922.

[If our correspondent had applied to a firm specialising in electric heating and cooking, or to the Temple of Publicity itself—the Electrical Development Association—he would have received all the literature he wanted, and more also.—Eds. Elec. Rev.]

Shift Engineers' Salaries.

I wonder if you could allow me a small space in your columns in which to say how glad I am to see shift engineers are speaking out.

Many others, like myself, have carried on, hoping that something would be done through the recognised channels, but promises are not always kept, and such "little" things cause amusement when mentioned now. The fact of being at the "base" is honour enough perhaps! but if the base of a ladder slips the man at the top has the longest drop.

Perhaps if this is realised in time something may yet be done.

One of Four.

November 27th, 1922.

I am in full accord with the letter written by "Industrial" in the current issue of your valuable paper, although only a charge engineer myself, and would like to say that I obtained considerable increases under the 20 per cent., plus £90, award and also under the salaries schedule. These increases were entirely due to the activities of the E.P.E.A., and unless I am the only charge engineer in the kingdom it is only reasonable to expect that all other charge engineers benefited to a similar extent; at any rate, I am personally acquainted with a great number who did. Apart from this I trust that we do not intend to remain charge engineers all our lives, even if berths off shift-work seem as remote as Heaven, and probably some time before we reach that haven of bliss we shall obtain positions higher than Grade 8, and then we may not feel quite so sorry for ourselves as we are at present.

As an hon. official of the E.P.E.A. for a number of years, I should like to point out to the grumblers of Grade 8 that if they would attend their section meetings regularly, they would see, probably much to their astonishment, that the E.P.E.A. has done something for them and will continue to do so. With regard to the plaint of "Midland Counties," that no amendments have been put forward to improve the grading of charge engineers, I recommend him to question the chairman of his next section meeting and he may hear of something to his advantage, and I should like to point out that these meetings are the proper places to air one's grievances.

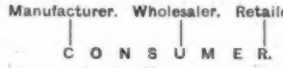
Members should read the *Journal*, and if they must grouse on paper let it be in the paper that is run for their benefit, and not take up valuable space in the columns of the Electrical Review, which could be used to far greater advantage by matters of more importance and general interest.

P. G. H.

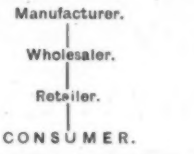
November 27th, 1922.

Electrical Trading Relations.

I was glad to see Mr. H. F. Simon's letter in your last issue. In connection with it I would like to refer to one of the diagrams which Mr. Wallace Attwood showed at his first E.D.A. lecture on "Salesmanship." This diagram was presented thus:—



My letter in your jubilee number suggested that the flow of business in the electrical trade should proceed from the manufacturer through the wholesaler and the retailer to the buyer, so that Mr. Wallace Attwood's diagram, instead of presenting the units in parallel, should present them in series, thus:—



There is a vast difference between these two methods, and the electrical trade will proceed on more successful lines when series, and not parallel, working of its chief sections is achieved.

W. E. Warrilow,
Lionel Robinson & Co.

London, *November 28th*, 1922.

I agree with the views expressed by Mr. W. E. Warrilow and Mr. H. F. Simon regarding the necessity for the fullest co-operation between supply authorities, manufacturers, wholesalers, and retailers. It is apparent that salesmanship has been somewhat neglected by the electrical industry in the past, and I am pleased to find the interest aroused by the E.D.A. conferences and the articles in the ELECTRICAL REVIEW.

Co-operation between the various interests involved is very necessary, and at the present time is increasingly apparent through various joint meetings and informal chats which are taking place. The E.D.A. is devoting a great deal of time to this matter with, I consider, some degree of success.

I do not think that Mr. Simon is correct when he states that the manufacturers are best qualified to sell "cooking, water-heating, and other specialised appliances." The manufacturer, on the one hand, sells only goods of his own manufacture, which may be the best in certain circumstances, but not in all. The retailer, on the other hand, is in touch with all makers of apparatus, and can sell the most suitable make for the particular conditions, thus giving better service to the user.

I am aware that some contractors do not try to sell electricity as they might, but firmly believe that if manufacturers and supply authorities would assist by wise publicity, and leave the actual selling to the contractors, the whole of the sales to users would be made by the contractors (retailers) at less expense than if the manufacturers dealt direct with the users.

I do not believe that methods of inter-trading can be discussed in E.D.A. open meetings with any good result, as much mud-slinging would probably take place, and some of the mud would stick and cause bad feeling. These matters require most deliberate thought, and can best be handled by small joint committees which could, I think, formulate a policy which would be acceptable to all parties.

I trust the Sales Conferences and discussions which are taking place will open the eyes of all in the industry to the importance of selling "the idea of electricity," and thus increase the demand for apparatus of all kinds.

W. Cross, M.I.E.E.

Newcastle-on-Tyne, *November 27th*, 1922.

I fear that your readers will infer from Mr. Simon's remarks in your last issue that gas for heating is always cheaper than electricity. Mr. Simon in his letter says: "First, and most important, the necessity of supplying electric power at a figure competitive with gas." Possibly your contributor had domestic heating in mind, for his statement certainly does not hold good as far as industrial production is concerned.

Numbers of British and foreign manufacturers are hardening in Wild-Barfield electric furnaces articles ranging from sewing needles to the gear wheels of motor cars at a cost of 34s. per ton. This is always our cost of production for hardening steel articles with power at 1d. per kW. In one of the largest industrial centres in this country these furnaces are effecting a saving over gas of 40 per cent. We have not yet one instance where town gas is cheaper than electricity so far as furnaces are concerned.

Automatic and Electric Furnaces, Ltd.,
E. P. BARFIELD,
Managing Director.

London, *November 28th*, 1922.

Standard Brush Holders.

Our attention has been drawn to a letter in your "Correspondence" columns on the above subject which, perhaps, calls for some comment from ourselves, although a modest and silent one has already been made in reply to the claims made by the Standard Brush Holder Co., by our page advert. in your issue of October 6th, wherein we illustrated our standard brush holder, and we had intended to leave it to your readers to judge of the added value, if any, the S.B.H. Co.'s pattern may have, seeing that, in principle, it is clearly nothing less than a copy of our own standard, slightly altered in detail, and to our minds not so efficient, as essentially the fixed position on the bar is not universal for radial adjustment, as is the Flather type.

We learn that this new holder is claimed to be the result of a collaboration of the leading motor manufacturers. This must be intended to read "some of them," for we ourselves were not consulted, which is perhaps rather significant.

As you, Sirs, and most of your readers are aware, we have been manufacturing dynamos and motors for the past thirty years, and during that time we have been flattered many times that so many of our details are being copied by our friendly competitors, to which we have raised no objection, nor will we do so, as it is not our policy to be rushing to the Patent Office repeatedly, but rather that if we have anything good all may share in it.

Nevertheless, it seems rather stupid that others should patent such designs, as obviously they are wasting money and giving a very wrong impression.

Flather & Co., Ltd.,
C. MARGERISON.
London Manager.

London, *November 7th*, 1922.

Applications to Box Numbers.

I have been a reader of your paper this last sixteen years, and during that time I have answered dozens of applications under the heading of "Situations Vacant," to box numbers, but have only received about three answers to these applications.

Being a practical engineer I am possibly not an adept at brilliant composition, &c., so that I could relate my experiences and talents in glowing fancy language, and unfold all my private concerns. I have certainly gone so far as to ask my friends who are considered smart in correspondence to give me an impressive epistle.

It is a firm conviction with me that the people or firms who have these advertisements inserted can be divided into two sections, and possibly an assorted third, *viz*: the genuine advertiser; and, secondly, the inquisitive employer who does not actually require a person for the post advertised, but is simply testing how many men there are in the unemployment market, and also the minimum salary such men are asking.

I think it only fair that the firm requiring a man should append its name and address to the advertisement, seeing that the particulars generally required are of a personal or private nature, and not information to be thrown about at random.

I know of a case of a firm advertising for a man to fill a certain position, and amongst the applications received was one from one of its own employés. No doubt you can imagine the consequences.

Now, coming to the point, I suggest that all would-be applicants for situations vacant should refrain from answering the box numbers, and wait until the employer realises that to get the man he requires he must cease advertising under box numbers, and come into the open and inform the applicants who he is by placing the name of the firm at the end of the advertisement; then I am sure he will get the fullest details possible given to him in confidence, and it would give the applicant much more encouragement.

I remember, some little time ago, correspondence appearing in your paper with regard to the giving of the intimation of the post being filled, but even this has not been made use of as it should be, a great number of firms not having the courtesy to put the minds of their applicants at rest by informing them that they are unsuccessful.

It is a common-sense conclusion that if a firm genuinely requires a man it will certainly pay postage to inform the successful candidate, but it is the least it can do to inform the unfortunate ones by inserting a notice that the post has been filled.

Practical Engineer.

[We sympathise with our correspondent in his unfortunate experience. The use of box numbers, however, is not likely to be abandoned by advertisers. Our Advertisement Department endeavours to mitigate its disadvantages by withholding replies (when so instructed) in accordance with the notice printed at the head of "Situations Vacant," and by inserting notices of appointments being filled, free of charge. Useful advice on drawing-up applications for employment was given in our issue of June 16th, 1922, p. 857.—EDS. ELEC. REV.]

PARLIAMENTARY NOTES.

(By Our Parliamentary Reporter.)

Trade Facilities Act Guarantees.—On November 27th, Mr. Baldwin, the Chancellor of the Exchequer, informed Mr. Briggs that, among others, the Government had agreed to give guarantees under the Trade Facilities Act to the London Electric Supply Corporation (£650,000), to the Oxford Electric Co., Ltd. (£25,000), to Harland & Wolff, Ltd. (£95,000), to the Kassala Railway Co., Ltd. (£1,500,000), to the Tata Power Co. (£850,000), and to the South-Eastern and Chatham Railway (£5,500,000).

Telephones in Rural Areas.—On November 28th, Mr. Millar asked the Postmaster-General whether he was prepared to institute an inquiry into the question of providing a wide extension of the telephone system in rural areas at reasonable rates to meet the requirements of the agricultural and other rural industries. Mr. N. Chamberlain replied: In view of the very favourable terms on which new exchanges are now opened in rural areas, the very low tariff for rural party lines, and the rapid growth in the number of rural call offices and telephone subscribers, I do not consider that there is any case for an inquiry at present.

Replying to Mr. Foot, Mr. N. Chamberlain said: Since May last about 200 new exchanges in rural areas have been authorised. In the same period 437 call offices have been opened at provincial post offices, chiefly in rural districts, and about 200 more have been authorised and are awaiting completion. The number of rural party line telephones in use has increased by 1,850 since May 1st.

London Telephone Exchanges.—On November 28th, Sir Harry Brittain asked the Postmaster-General whether his attention had been called to the varying degrees of efficiency of the various London telephone exchanges; and whether he was able to state which exchange, in the opinion of the department, was worked with the greatest satisfaction to the subscribers and which exchange was the subject of the greatest number of complaints. Mr. N. Chamberlain said that statistics which gave some indication of the comparative efficiency of the various London telephone exchanges were periodically prepared and utilised by his department, but in view of the many factors involved, including differences in local conditions, he did not think it was possible, consistently with justice to the staff concerned, to publish a list of exchanges in order of merit.

BUSINESS NOTES.

Bankruptcy Proceedings.—William Ford, residing at Swan Street, Alvechurch, and lately trading as the "Redditch Electrical Accessories Company" at Central Chambers, Unicorn Hill, Redditch.—A meeting of the creditors was held on Thursday last week at the office of the Official Receiver in Birmingham. A deficiency of £189 was disclosed, and the failure was attributed by debtor to bad trade. He was formerly, until 1917, an electrical engineer at the General Post Office, Birmingham. Then he commenced business at Alvechurch in partnership with a Mr. J. W. Falkner, who died in November, 1917. In February, 1918, the debtor was joined in partnership by a Mr. Larner, and the business was removed to Redditch. By reason of disagreements, the partnership was not a success, and it was dissolved in 1920, the debtor retaining the assets and taking over the liabilities. There was a further partnership with a Mr. Millward, and although this was not dissolved, this partner obtained a situation and took no active part in the business, which later became very depressed. The Official Receiver is the trustee.

George William Humphry, 24, Broad Quay, Bristol, trading as the Humphry Electrical Co., electrical engineer.—The public examination of this debtor was held on November 17th at the Guildhall, Bristol. The ranking liabilities were returned at £467, and there was a deficiency of £156. Debtor had traded at different places in Bristol since 1917. Two years ago he was appointed a director and engineer of an electrical company, but later he withdrew. He now had a claim of £234 against the company for commission. The examination was adjourned.

W. C. Ellis, electrician, Applegate Street, Leicester.—Application for discharge will be heard on December 20th at the Castle, Leicester.

G. Hill and E. Cowley (G. Hill & Co.), electrical engineers, 22, Chantry Lane, Great Grimsby.—Last day for proofs for dividend, December 9th. Trustee: Mr. J. F. Wintringham, St. Mary's Chambers, Great Grimsby.

Francis Leopold Perrin, electrical engineer, residing at and carrying on business at 57, Wellingborough Road, Northampton, and also carrying on business at 5, College Street, Northampton.—The statement of affairs in this bankruptcy shows gross liabilities of £2,885, of which £2,740 is estimated to rank against the estate. The assets are estimated to produce £611, and the deficiency is shown as £2,120. The debtor attributes his failure to the slump in trade, to bad debts £238, loss on contracts, £300, loss on sale of motor-car, £100, and to competition. The deficiency account includes £385, estimated depreciation of stock-in-trade. The Official Receiver (Mr. J. Osborne Morris) in his observations, states that the debtor, now aged 33, was apprenticed to his father, who was an electrical engineer. His father died 13 years ago, and the business was continued by the debtor's mother, for whom he worked for three years, when he commenced business on his own account in a small way at 15, Kingswell Street, Northampton. He had no free capital, but borrowed £50 from relatives. The business proved a success, and in 1915 he removed it to 5, College Street, Northampton, a lock-up shop. The business continued to prosper, and debtor undertook a number of contracts. By way of extending the business he borrowed £200 from relatives, and that amount is still owing. About two years ago the decline in business generally affected him, and about that time he lost between £150 and £200 on contracts, and also sustained losses on book debts. Further, when the slump began, he found that he had considerably over-bought, and consequently the value of his stock was great depreciated by the heavy fall in prices. Difficulty in meeting accounts followed, and, later, recourse was had to registered money-lenders, borrowing from one to pay another. One outstanding contract, which is being completed, is expected to bring in £175. The statement of affairs discloses unsecured debts: £448 borrowed from registed money-lenders, £114 borrowed from friends and relatives, £23 personal expenses, and £1,854 for trade goods, trade expenses, and law costs. The fully-secured creditor, a banking company, holds two life policies on security for an overdraft.

F. C. Jinks and S. J. Watson (Vulco Magneto Co.), 11, Long Acre, W.C.—Order made October 31st. Bankrupts' discharge suspended for three months.

W. Camp (W. Camp & Co.), electrical engineer, Carr Lane, Slaithwaite, Huddersfield.—Trustee, Mr. W. Durrance, Official Receiver, 12, Duke Street, Bradford, released November 22nd.

T. Rawsthorne, electrical engineer, 67b, Paradise Street, West Bromwich.—Trustee, Mr. E. E. Deane, Official Receiver, 191, Corporation Street, Birmingham, released November 22nd.

Company Liquidations.—Modern Electrical Supply Co., Ltd., Whitecross Place, London, E.C.—A largely-attended meeting of the creditors of the above was held on November 22nd at the offices of Messrs. Gray, Stainforth & Co., C.A., 31, Lombard Street, London, E.C. Mr. Rodway Stephens, the liquidator of the company, submitted a statement of affairs which disclosed ranking liabilities of £4,054, all of which were due to trade creditors. The assets were estimated to realise £5,214, from which had to be deducted £148 for preferential claims and £5,049 due on debentures. The net assets, therefore, totalled £26, or a deficiency, so far as the creditors were concerned, of £4,028. The assets were as follows:—Cash in hand, £5; cash at bank, £158; book debts, £2,460, estimated to produce £2,000; stock-in-trade, £3,717, valued at £3,000; furniture and fittings, £50.

The liquidator stated that the company was registered on August 15th, 1921, with a nominal capital of £1,500 to carry on the business of electrical engineers and dealers in electrical goods. Of the capital, £430 was issued as fully paid to Mr. G. S. Stone and Mr. G. A. Davenport, while Mr. A. T. Whittle took up shares to the value of £500 for cash. Subsequently it was found that the capital of the company was insufficient, and in November, 1921, it was increased by the issue of 200 preference shares of £10 each. All those shares were taken up by Mr. A. T. Whittle, and paid for in cash. Later, further capital was required, and Mr. Whittle advanced £5,000 on the security of debentures. The debentures were issued on March 9th last, at which date Mr. Whittle had lent £4,000, and he subsequently lent a further £1,000. The accounts for the year to July 31st last showed a loss of £3,180. That loss was attributed principally to the low rate of gross profit which was earned. During recent months the company had been pressed by creditors, and unsuccessful attempts were made to enter into an agreement with them. The debenture-holder had appointed a receiver. The latter was of the opinion that the stock would only realise £2,500. That meant that the assets would be insufficient to fully meet the claim of the debenture-holder, and there would be nothing whatever for the unsecured creditors. The failure of the company was attributed to the fall in the value of the stock, the very small margin of profit obtainable, owing to the fact that consumers could obtain identical terms from manufacturers, with the result that the company had to deal with small firms and run the risk of bad debts. The company had also suffered by the heavy purchase of wireless sets, which, owing to the delays in the broadcasting scheme, there was very little demand for. The stock included wireless sets and accessories to the value of £1,000. The turnover of the business during the year to July 31st, 1922, was only £15,000.

The representative of Messrs. Watsham & Co. asked the liquidator if he had in any way investigated the position between the company and the Kent Coast Electrical Co. at Broadstairs.

The liquidator said he understood that the Kent Coast Co

was a private venture of Mr. A. T. Whittle's, and dealt in electrical goods. He believed that Mr. Whittle obtained his supplies from the Modern Electrical Co.

Messrs. Watsham's representative complained that on November 4th the Modern Co. telephoned and demanded that goods should be sent at once.

Two or three other creditors also stated that goods were obtained from them at recent dates, and one creditor said he supplied goods at a date when the company had issued a notice calling the shareholders together for the purpose of passing the resolution for liquidation.

The chairman stated that up to the date of the liquidation negotiations were in progress by which it was hoped a compromise would be effected with the creditors. The meeting for voluntary liquidation was called as a provisional measure. He went on to state that the balance-sheet last July showed assets of £6,800, against debentures of £5,000, and trade creditors' claims of £1,900. At that date the company appeared to be about £100 on the wrong side.

Mr. P. Houstoun, of Messrs. Corfield & Cripwell, pointed out that since July 31st the indebtedness to the trade had increased from £1,900 to over £4,000. As late as October 20th the position of the company was known to the directors, and yet on November 1st it received £88 worth of goods from one of his clients, and £200 worth of goods from another firm which he represented. Such a proceeding, he declared, called for a great deal of explanation.

Mr. A. T. Whittle was asked by a creditor whether he was aware that the company was insolvent on September 13th last, and he replied that he did not wish to answer the question. He was not proposing to make any offer to the creditors, and pointed out that he had lost heavily through the failure of the company.

A creditor pointed out that after October 26th, when the resolution for voluntary liquidation was issued, the wholesale houses in the trade were being pressed to deliver goods.

The representative of the Maxim Lamp Works said that on October 16th he received an order for goods to the value of £600, and he wanted an explanation as to why the company received goods from him after that date.

A suggestion was made that the representative of Messrs. Corfield & Cripwell should be appointed as liquidator of the company, but Mr. Houstoun said he could not agree to that course, as he thought it was a case for compulsory liquidation. It did not appear that the creditors would receive anything, but it was a case where trading of such a description should be exposed. In such cases, if they allowed a respectable burial to take place under voluntary liquidation, they would be asking for trouble, and within a few months they would be met with 20 or 30 similar cases.

The solicitor to the liquidator said he did not think that the creditors could pass any definite resolution other than one referring to the voluntary liquidation, and it was then decided that the meeting should be adjourned for ten days.

An informal meeting of the creditors was subsequently held under the presidency of Mr. Houstoun, when the representative of the Maxim Lamp Works declared that the circumstances of the case seemed to be so unsavoury that he thought the fullest investigation was necessary. He proposed a resolution expressing the opinion that it was desirable that the company should be wound up compulsorily, and that the general body of creditors should be recommended to subscribe towards the costs of the petition to an extent not exceeding 2½ per cent. of the amount of their respective claims.

The representative of Messrs. Callender's Cable & Construction Co. seconded the motion, which was carried unanimously, and an informal committee of three of the creditors was also appointed.

The principal creditors are:—

	£		£
Associated Electric Trading Co., Ltd.	81	General Electric Co., Ltd.	332
Automatic Telephone Mfg. Co., Ltd.	66	Geipel, W., & Co.	75
British Thomson-Houston Co., Ltd.	144	Henley's Telegraph Works, Ltd.	84
Belling & Co.	71	Langham Electrical Supplies Co.	85
Bapsty, S.	72	Maxim Lamp Works	94
Catchpole & Morris	164	Mullard Radio Valve	87
Cable Accessories Co.	212	Rose Bros. Electrical Co.	50
Dawson, W., & Co.	169	Russ, J.	86
Dwyer, P. L.	115	Smith, J. & W. B.	139
Ever-Ready Co.	77	Higgs Bros.	50
Falk, Stadelmann & Co.	92	Wootten, H. A., & Co.	60
		Watsham & Co.	175
		Wireless Instrument Mfg. Co.	50

"Watt" Electrical Co., Ltd., 161, Westminster Bridge Road, London, S.E.1.—A meeting of the creditors was held on November 23rd, at the Institute of Chartered Accountants, Moorgate Street, E.C. The chair was occupied by Mr. H. Gardner, of Palmerston House, E.C., who had been appointed to act as the liquidator in the voluntary liquidation of the company. The statement of affairs presented showed liabilities of £929, while the assets were estimated to realise £517. After allowing £118 for preferential claims, the net assets were £399, or a deficiency of £530. The assets consisted of cash at bank, £16 10s. 6d.; stock in trade, £431, expected to produce £250; fixtures and fittings, £25; good book debts, £136; and bad and doubtful debts, £228, estimated to realise, £90. The liquidator reported that the company was registered on January 20th last for the purpose of taking over a business which had previously been carried on by Messrs. E. H. Whatton and L. N. Abrey under the style of the Watt Electrical Co., at Railway Approach, London Bridge, S.E. The company purchased stock valued at £258, which was satisfied by a cash payment of £160, and the discharge of existing liabilities amounting to £98. Shares to the value of £400 were issued for cash. No remuneration had been drawn by the directors. At a later date further shares were issued to the extent of £100. During the summer the company entered into negotiations for the acquisition of the rights of a new electrical advertising device. The directors were, perhaps, excessively optimistic, and increased the capital of the company to £5,000. No further capital, however, was issued, and larger premises were acquired at Westminster Bridge Road. In the middle of October, the financial position became acute, and liquidation was decided upon. The books of the company had been kept in a somewhat elementary fashion. The present position of the company was due to the acquisition of a larger stock than was justified by the immediate prospects of business, carrying out contracts at unremunerative prices, and the failure of the negotiations with regard to the advertising sign. Since its incorporation the turnover of the company had only been £1,610. During the discussion which took place, certain creditors expressed dissatisfaction at the position, but eventually it was decided to confirm the voluntary liquidation of the company, with Mr. Gardner as liquidator. The following are creditors:—

	£		£
Abrey, L. N.	111	Lee, Albert, & Co.	29
A. & A. Electrical Co., Ltd.	10	London Electric Supply Corp.	17
Beardmore, F. W.	116	Magic Appliances, Ltd.	14
British Central Electrical Co.	24	McCaw, Ltd.	21
Steer, A.	10	Metropolitan-Vickers, Ltd.	20
Brown Bros., Ltd.	35	Newberry & Thomas	11
Brown & Hart	12	Sloan Electrical Co., Ltd.	29
Electrical Conduits, Ltd.	11	Stella Lamp Co., Ltd.	52
General Cable Manufacturing Co.	14	Visible Typewriter Co.	29
General Electric Co., Ltd.	42	Theatres Advertising Co.	10
Hogan & Wardrop	13	Waller, G	25

The Bell Battery Co., Ltd., Laburnum Grove, Ilford.—Pursuant to Section 188 of the Companies (Consolidation) Act, a meeting of the creditors in this matter was held on November 21st at the offices of Mr. F. Wilcock, C.A., of 1, Great Winchester Street, E.C., when a statement of affairs was presented, showing total liabilities amounting to £6,249 and assets (gross) £315, from which had to be deducted £39 12s. 4d. for preferential claims and £800 for debentures, which left no assets available to meet the claims of unsecured creditors. The assets consisted of cash in hand, 9s. 9d.; stock-in-trade, £608, estimated to produce £100; trade fittings, &c., estimated at £40; and book debts, £175. So far as the shareholders were concerned, there was stated to be a total deficiency of £15,873. The capital of the company issued and allotted included 60,000 ordinary shares of 2s. each and 3,100 preference shares of £1 each. Mr. Wilcock reported that the company was formed in October, 1919, and took over an existing business of cell manufacturers, &c. The goodwill of the business was said to be of no value. The business had been advertised for sale as a going concern for a week, but nothing had yet resulted. The business was still being carried on by Mr. Wilcock. After discussion it was decided to leave the matter in the hands of Mr. F. Wilcock as liquidator. The following are creditors:—

	£		£
Dussek Bitumen Co.	10	Fuller's United Electric Works, Ltd.	36
W. T. Bruce & Co.	21	Poulton Bros.	67
Hillbar Press	80	Clarke, —	10
Electrical Engineering and Equipment Co., Ltd.	678	Bankers	3,020
Fletcher, —	28	Elliott, —	100
Le Carbone	31	Seligman, —	697
Grey & Martin, Ltd.	25	Edenborough, —	300
Hugh Stevenson, Ltd.	27	Cornelis, —	100
Hardware Trade Journal	16	Managing director	320

Cesco, Ltd., electrical engineers, Cardiff.—The creditors interested herein were called together recently at 8, Westgate Street, Cardiff, when Mr. A. H. Smith, the liquidator in the voluntary liquidation of the company, submitted a statement of affairs, which showed total liabilities of £5,162, made up as follows: trade creditors, £1,816; amount due to vendors on the transfer of the business, £1,600; banker's claim, £1,725; and Cardiff Corporation for rates, £21. The assets were estimated to realise £4,110, or a deficiency of £1,051. The assets consisted of stock, £2,329; fixtures and fittings, £190; book debts, £1,587; and cash in hand, £3 19s. 6d. It was reported that the company was registered in October, 1921, the stock being purchased for £2,500. It was arranged that the company should purchase the stock for a cash payment of £500 and discharge the balance by quarterly payments of £250. Since the company was formed the stock had depreciated in value owing to the fall in the market. The bank held a first debenture over the assets as security for its claim, and had appointed a receiver. The debenture was for the face value of £2,000. After a short discussion, a resolution was passed confirming the voluntary liquidation of the company, with Mr. Smith as liquidator, while a committee of three of the principal creditors was appointed.

British & Allied Electrical Agency, Ltd.—Winding up voluntarily. Liquidator: Mr. St. J. Bennett, 16, Devonshire Square, E.C. Meeting of creditors, December 11th. Particulars of claims to be sent to the liquidator by December 30th.

Dalziel's Constant Voltage Patents, Ltd.—Winding up voluntarily. Liquidator: Mr. S. T. Hall, 24, The Strand, Derby. Meeting of creditors, December 2nd. All creditors will be paid in full in due course.

Weldrics, Ltd.—Particulars of claims to be sent to the liquidator, Mr. R. R. Callingham, 34, Nicholas Lane, E.C., by December 23rd.

Tyne Electric Steel Foundries, Ltd.—Particulars of claims to be sent to the liquidator, Mr. J. G. Swan, 31, Mosley Street, Newcastle-on-Tyne, by December 21st.

National Electric Supply Co., Ltd.—Meeting of members is called for December 27th at 11, Winckley Street, Preston, to hear an account of the winding-up from the liquidator, Mr. W. H. Ainsworth.

Dissolutions of Partnership.—Lucas & Bach, electrical engineers, 5, Bull Ring, Birmingham.—Mr. A. W. Lucas and Mr. H. F. Bach have dissolved partnership. Mr. Bach will attend to debts and continue the business on his own account.

Car Lighting & Ignition Supply, electrical engineers, 54, Leamoor Road, Westbourne, Bournemouth.—Mr. A. W. Iles and Mr. T. Cartledge have dissolved partnership. Debts will be attended to by Mr. Iles.

Trade Announcements.—The firm of L. W. Douthwaite and Co. has been converted into a private limited company. Mr. Douthwaite joined the late firm of Chas. A. Muller in 1901, and for eight years was the manager. In 1916 the business was taken over by him as sole proprietor. The present conversion into a company is for private reasons. Mr. Barnes, who has been associated with the firm for the last 14 years, becomes, with Mr. Douthwaite, one of the first two directors. There will be no change in the conduct of the business.

Consolidated Pneumatic Tool Co., Ltd.—Owing to expiry of the lease, the company has removed the pneumatic and electric repair shops and show-rooms from 73-75 and 79-80, Petty France Street, Westminster, to 23a, Bramber Road, West Kensington, W.14.

Mr. Thomas T. D. Geesin, of 4, Clevedon Road, Penge, announces that his telephone number is now "Sydenham 2704."

Catalogues and Lists.—Messrs. Hick, Hargreaves & Co., Ltd., Soho Iron Works, Bolton.—An illustrated description of a closed-feed system for the complete de-aeration of boiler-feed water.

Sterling Telephone and Electric Co., Ltd., 210-212, Tottenham Court Road, W.1.—Publications No. 333, describing special head 'phones for ladies' use; No. 336, dealing with the "Stadium Magnavox" loud speaker; and No. 337, advertising a rotary filament resistance.

Messrs. A. P. Lundberg & Sons, 447-489, Liverpool Road, N.7.—List S.40, illustrating and describing numerous types of tumbler switches, plugs and sockets, &c. Fully priced.

Electrical Utilities, Ltd., 1-3, Shelgate Road, Battersea Rise, S.W.11.—Leaflet M.T. 1, illustrating and describing the "Utility" multiple toaster.

Dugdill's Patents, Hazel Grove, Stockport.—A mailing card illustrating numerous types of lighting brackets, standards, &c.

Radiophones, Ltd., 1a, Granville Place, Marble Arch, W.1.—A priced catalogue of complete radio-telephony receiving sets and components.

Messrs. Meldrums, Ltd., Timperley, near Manchester.—An illustrated pamphlet describing the "Meldrum" oil burner and its applications.

Batteries, Ltd., Redditch.—List No. 1, describing several types of nickel-iron accumulators for various purposes.

Messrs. Crossley Bros., Ltd., Openshaw, Manchester.—Publication No. 2,229—a reprinted article from *The Engineer*, describing a "Premier" wood-fuel, suction-gas plant at a Rhodesian mine.

Leeds Electrical Construction Co., Ltd., Charmouth Street, Leeds.—An illustrated brochure describing "Losles" automatic temperature control gear.

Brittain's Electric Motor Co., 110, Cannon Street, E.C.4.—A series of pamphlets giving particulars and prices of 1-, 2-, and 3-phase slip-ring and squirrel-cage motors for all voltages and frequencies.

For Sale.—Nuneaton Electricity Department has for disposal one battery of 250 Chloride cells, two switchboard panels, complete, charging booster, &c. (See our advertisement pages to-day.)

Trading Relations with Latvia.—Latvia is one of the small Republics created by the war, and although it has a population of only 2,000,000, nevertheless it affords an opening for a variety of goods needed to supply a substantial community, among which goods are machinery, locomotives and railway material, automobiles, iron goods of sundry kinds, autogen apparatus, &c. It has founded a trade organ entitled *Latwijas Tirgotajs* or the *Latvian Merchant*, and in its 10th number makes an appeal, in English, for the creation of mutual trade relations with this country, which, it is said, may lead to the opening up of trade with Russia, Persia, and other Eastern markets with which Lithuanian merchants are connected. The Germans have hitherto monopolised this market, and German is the only foreign tongue known there; but the Letts have taken steps to remedy this by having English taught in their leading schools. The Union of Latvian Merchants (10, Aspasia bulv., Riga), owners of the periodical mentioned, offers its services to those seeking further information regarding this new market.

New French Companies.—The Société de Distribution de Gaz et d'Electricité de Saint André et Extensions has been constituted at the place named (Eure department) with a capital of 190,500 fr. in 380 500-franc shares, 100 of which are allotted to M. Damoy, the founder of the company.

With the object of the development of a waterfall called "Roche-qui-Bruit" and the supply of high-pressure current in the neighbourhood, a company styled Energie Electrique du Roche-qui-Bruit has been formed at Saint Brice en Cogles (Ile-et-Vilaine), with a capital of 200,000 fr., subscribed in cash.

The Société Hydroélectrique de Rivière Basse has been established at Castlenau (Hautes Pyrénees) for the building and working of a generating station. Capital, 100,000 fr.

There has been formed at Baugé (Place du Château) the Société de Distribution et d'Applications Electriques du Beaugeois, with a capital of 500,000 fr. in 976 shares of 100 fr. each and 120 fifth shares of 20 fr., 186 of the former class and the whole of the latter being given to the Société Beaugeoise d'Electricité as consideration for its assets.

La Distribution Electrique is the style of a company embodied at Paris (11, Rue Bouchardon), with a capital of 220,000 fr., with the object of installing and working electric lifts in Parisian houses.

Buying Organisation in Birmingham.—Steps are being taken to give effect to the principle of co-operative buying for the purpose of standardising and co-ordinating the purchase of all goods and stores required by the various departments of the Birmingham Corporation. Mr. A. Baker, of the tramways department, is chairman, and Mr. E. J. Jennings (secretary of the electric supply department) vice-chairman.

Book Notices.—"The Metropolitan-Vickers Gazette," October, 1922. Price 1s. post free.—The principal articles in this issue are: "The Raanaasfoss Power Station," by G. Franklin; "Electric Traction," by Sir V. Raven; "Protective Apparatus for Turbo-generators," by J. A. Kuyser; and "Post-War Electrical Driving Equipments in Lancashire Cotton Mills," by V. Mallalieu.

"*Journal* of the American Institute of Electrical Engineers," Vol. XLI, No. 11. November, 1922. New York: The Institute. Price $1.

"The Quantum Theory," by F. Reiche. Pp. v+184; figs. 15. London: Methuen & Co., Ltd. Price 6s. net.

"Administration of London: Electricity Supply, 1920-21." (58 pp. and two maps). London: The London County Council. Price 5s.

Callender's Musical Society.—We are pleased to learn that Callender's "Anchor" Cable Works Musical Society (Leigh), established only three years ago, attracted crowded houses to the local Hippodrome every night last week with its production of the ever-popular Gilbert and Sullivan opera, "The Mikado," achieving success highly creditable to principals and chorus alike. The opening performance was under the personal patronage of Sir T. O. Callender, J.P., accompanied by representatives of the firm's London and Leigh management. On the Friday night 1,200 school children were present in response to an invitation to compete for prizes offered for the best essays on the performance; the Mayor and Mayoress were present. A special film showing the process of cable-making at the "Anchor" works was screened each evening.

International Court of Arbitration.—The International Court of Arbitration will hold its inaugural session in Paris on January 18th, when it is hoped that 100 delegates from all parts of the world will be present. The Court has been formed by the International Chamber of Commerce for the purpose of hearing commercial disputes and settling them without the disputing parties having recourse to legal proceedings. An executive resident committee has been elected. Decisions given by the Arbitration Court will, of course, be morally binding, as contending parties will be asked to sign an agreement consenting to abide by the Court's decision, but in certain countries such decisions are also legally binding. The committee is preparing a brochure for the use of commercial men, showing how far commercial arbitration is admitted by the legislation of different countries. The International Chamber of Commerce advises business men to insert a clause in their international contracts, whereby the contracting parties agree to submit to the Arbitration Court any difference which may arise with regard to the contract, and to abide by the decision of the Court. It is estimated that the Court will not take more than a maximum period of 60 days to render a decision with regard to any dispute submitted to it.—*Reuter* (Paris).

Sentence for Lamp Stealing.—Christopher O'Brien (29), of Liverpool, at one time a meter-reader employed by the Liverpool Corporation electricity department, was last week, at the Liverpool Police Court, sentenced to four months' imprisonment for stealing twelve electric lamps, value £3, from the premises of Boots' Cash Chemists, Church Street, and six electric lamps from Messrs. Downes & Davies, Stanley Street.

Large A.E.U. Expenditure.—A circular showing the amount expended during the two years ended in June last has been issued by the Amalgamated Engineering Union. Unemployment benefit absorbed a sum of £4,056,458, and sickness payments and superannuation took £800,000. Special levy payments amounted to £577,256. Administration costs totalled £522,307, equal to 2s. 6½d. in the pound.

E.D.A. Activities.—The Electrical Development Association heralds the near approach of the Christmas season with a bunch of special "literature" aiming at the inculcation of the "electrical gift idea." This includes a large poster depicting a postman about to deliver a parcel, and indicating the wide selection of electrical appliances which form suitable Christmas presents. Two pamphlets are in verse. One of these is a quaint combination of 18th-century English and illustrations with electrical appliances and modern terms. The other is reminiscent of the *Ingoldsby Legends*, although it is called "A New Christmas Carol." Another pamphlet deals with the practical nature of electrical gifts, and others are entitled "A Present Problem Solved."

The British Empire Exhibition.—Although it was stated in *The Times* of November 22nd that both Canada and Newfoundland had decided to participate on a large scale in the 1924 exhibition, it was stated in a subsequent issue of that journal that Mr. Larkin, High Commissioner for Canada, contradicted this, so far as Canada was concerned. It appears that the Dominion Government requires a definite assurance that the building materials will come from Empire sources. Mr. Larkin also said that he understood that certain statements had been made by the management reflecting upon Canada's ability to produce the commodities which she proposed to advertise at the Exhibition. He had seen no contradictions of these statements, and considered that a lack of tact had been displayed. The exhibition was designed to prove that the Empire was self-supporting; if it were not so, Canada could not see the use of spending a million dollars to advertise the fact.

Socials.—Last Friday evening a dance and concert was given by the Mullard Radio Valve Company to the staff and employés at the works at Hammersmith and Balham. The directors and their friends were present. The concert was carried out entirely by members of the firm.

The members of the York City Tramways Orchestra gave a concert last week at the City Mental Hospital, under the conductorship of Mr. Corbett. They were assisted by Miss Doris Dobson, Master Dunnington (of the Minster Choir), and Messrs. T. Clay, H. Pearson, and A. Peacock as vocalists.

Forthcoming Exhibitions.—The following exhibitions are being organised:—

London.—January 3rd and 4th, Physical and Optical Societies' Exhibition; February 19th to March 2nd, British Industries Fair; March 4th to 17th, Ideal Homes Exhibition; March 15th to 24th, Photographic Fair; June 1st to 4th, International Mining Exhibition.

Birmingham.—February 19th to March 2nd, British Industries Fair.

Edinburgh.—January 31st to February 14th, Scottish Ideal Homes Exhibition.

Hull.—April 20th to May 5th, International Domestic Economy and Trade Exhibition.

Belgium (*Brussels*).—April 9th to 25th, Commercial Fair.

Canada (*Toronto*).—August 25th to September 8th, Canadian National Exhibition.

Czecho-Slovakia (*Prague*).—March 11th to 18th, Samples Fair.

Finland (*Helsingfors*).—July 1st to 7th, International Samples Fair.

France (*Paris*).—January 20th to 28th, Agricultural Machinery Exhibition. (*Bordeaux*).—June 15th to 30th, Samples Fair. (*Lyons*).—March 1st to 15th, Spring Fair.

Germany (*Cologne*).—Spring, 1923, Samples Fair.

Italy (*Milan*).—April, Samples Fair.

Madagascar (*Antananarivo*).—August 15th to September 15th, International Commercial Fair.

Spain (*Barcelona*).—March 17th to 28th, International Samples Fair.

Switzerland (*Basle*).—April 14th to 24th, Swiss National Fair.

Trust Deed.—Robinson, Fraser & Co., electrical, mechanical and automobile engineers, Galapark Road, Galashiels.—Trust deed granted recently, as there was no offer of composition from the debtor. Claims have to be sent to Messrs. W. and W. B. Galbraith, 87, Vincent Street, Glasgow. The liabilities were estimated at £3,627 and the assets at £899, leaving a deficiency of £2,727.

The following is a list of creditors for over £25:—

Trade Creditors.—British Thomson-Houston Co., Ltd., £330; Baxendale & Co., Ltd., £81; Croall & Croall, £72; Coventry Chain Co., Ltd., £46; J. H. Holmes & Co., £490; W. T. Henley's Telegraph Works Co., Ltd., £41; Johnson & Phillips, Ltd., £483; Metropolitan-Vickers Electrical Co., Ltd., £30; Northern Manufacturing Co., Ltd., £28; F. & A. Parkinson, Ltd., £103; Sloan Electrical Co., Ltd., £161; Union Assurance Society, Ltd., £79; Wood & Cairns, Ltd., £30; sundry creditors under £25, £535—£2,510.

Cash Creditors.—Robert Stark, £200; Clement Oxby, £400; Bank of Scotland, £126; Frank Robinson, £390—£1,116. Liabilities per statement of affairs, £3,626.

New Belgian Company.—With a capital of 4,000,000 fr. in 8,000 500-franc shares has been formed the Société Belge Radio Electrique. Its scope is telegraphy and telephony, with or without wire, and the industrial and commercial utilisation of electricity.

The Motor-Cycle Show.—As is usual in the Cycle and Motor-Cycle Show, this year's display at Olympia contains many makes of magnetos and numerous lighting systems. Among the latter are the "Magdyno" system of the Lucas Electrical Co., Ltd., and the "Pedlite" cycle-lighting set made by Dekia, Ltd., of Birmingham, which consists of a tiny dynamo operated by the friction of the tire as the wheel revolves. This firm also shows a hand lamp containing a lever-driven dynamo. The Villiers Engineering Co., Ltd., has examples of its fly-wheel magnetos on view; these are very compact and obviate the gear connected with the usual types of magnetos. A wide variety of electrical goods appears on the stand of Messrs. A. H. Hunt, Ltd. The principal feature is a collection of Hellesen batteries of all sizes and shapes for lighting, wireless work, &c. A sign is exhibited which forms a very attractive advertisement. It consists of a semi-cylindrical case with a glass front, in which there are four lamps, each of which is of a different colour, having a reflecting screen in front of it. A thermal flasher gives numerous combinations, and each lamp has three distinct reflections in the back of the case, giving a constantly-changing variegation of colour. Other features of the stand are small protected inspection lamps, small push and screw lighting switches, and the "H. A. H." portable dry-battery hand lamp. The last is of simple but strong construction. The switch contacts, wires, and lamp contacts are all arranged inside a neat nickel-plated cover through which the switch lever projects. It is supplied with a "Hellesen" flash battery.

Messrs. W. Canning & Co., Ltd., exhibit electro-plating equipment, including low-voltage dynamos, unit-type resistance boards, nickel and copper anodes, plating salts, &c. In addition to these, there are polishing lathes, grinders, and polishing brushes.

Batteries, Ltd., have numerous examples of their "Jungner" system nickel-iron accumulators on show. By means of sections and separate plates, the strong construction of the cells is well demonstrated. Among the vehicles themselves there is an electric bath chair by the Argson Engineering Co., Ltd. In this a small motor drives a rear axle through a differential and two-speed gear. The current is supplied by a battery of Edison accumulators carried under the seat. The normal speed is 6 m.p.h., and a distance of 25 miles can be covered on one charge.

It has been observed that one outstanding feature of this year's show is the increased number of combined lighting and ignition systems. To-morrow (Saturday) is the last day of the exhibition.

Inquiry.—Messrs. Robertson Alexander & Co., combustion engineers, of 15, International Exchange, Edmund Street, Birmingham, ask for descriptive information of recently marketed appliances for increasing the efficiency of boiler-house plants.

Röntgen Tube Works at Petrograd.—A Russian journal announces the starting of the only Russian electric works producing Röntgen tubes in Petrograd.

Russia's Electrical Production.—Our contributor on Russian affairs informs us that the programme of production by the Electrotrust of the Central Region of Russia for the coming working year provides for the output by all the factories of the trust of goods to the value of 12,000,000 roubles, based on prices ruling in 1914. Compared with last year, the production scheduled for the lamp factories is increased by about 100 per cent., and for the carbon factory by 30 per cent. The production of the other factories remains at about the same as before, excepting the Elektropribor (electrical apparatus), and the Elektroisolyator (electric insulators), which the Board of the Trust has decided to close down. The production of the required materials will be effected at the "Dynamo" factory instead of at the Elektropribor. For the purpose of the due arrangement of production, the cheapening of goods and increased capacity in the new working year, considerable repair work is in view, besides fresh equipment and converted equipment in the factories. Thus the Poktoffsky and Meschansky lamp factories are to be transferred to other localities for the express purpose of almost doubling their productive capacities. Important work is being done in the fitting out of the Elektrougol factory, in its graphito-carbon section to provide electrodes for the metallurgical and chemical works, &c. At the Isolyator (insulator) factory the laboratory for testing insulators of high voltage will be completed.

Existing staffs will remain, and those of the lamp and carbon factories will be increased to deal with the larger programme of production. The personnel on October 1st this year at all the factories numbered 4,675. By the end of the year this figure is expected to be raised to 5,654.

In the stores of the Electrotrust there are old stocks mostly of non-current goods valued at over 7,000,000 pre-war roubles. These are not expected to yield more than 2,500,000 roubles.

Sales of new incandescent lamps are expected to yield 3,500,000 roubles; the porcelain factory has orders for high-voltage insulators for six months, and department orders are expected. In the machinery factories, with a production capacity of 2,350,000 roubles, orders are expected for 1,650,000 roubles. In the cable branch, orders are expected for 3,925,000 roubles, the productive capacity being 5,300,000 roubles value.

Vickers, Ltd.: Extended Objects.—On November 21st, in the High Court of Justice Chancery Division, the petition of Messrs. Vickers, Ltd., to extend the objects of the company was heard before Mr. Justice P. O. Lawrence. Among the reasons which led the company to make this application for the extension of its powers was the fact that although the objects of the company were extended in 1918 to enable it to use in post-war trade the buildings and plant which it had acquired during the war for national purposes, it was not then known in detail what use it might be possible to make of some of these assets. The powers then granted to the company were considerably extended by the present Court proceedings. After hearing the arguments put forward by Mr. Clauson, K.C., for the petitioners, there being no opposition, Mr. Justice Lawrence made the usual order confirming the resolutions extending the objects of the company. The additional powers conferred upon the company include: the holding of interest in coal and iron mines, brick-works, quarries, &c.; the manufacture, &c., of locomotives, tractors, motor cars, aircraft and other vehicles; dealing in explosives and the manufacture of all classes of optical and scientific apparatus; the construction of aircraft for commercial purposes, and of tramways, railways, roadways, bridges, tunnels, canals, hydraulic, electric and gas works, smelting works, refineries, kilns, cement works, quarries, garages and aerodromes; the manufacture of by-products of the company's various industries and other chemical and natural products; the granting of pensions, &c., to any employés and the establishment of institutions for their benefit; and the carrying out of research work.

The Russian Import Trade.—The Russian Trading Delegation in Berlin has issued figures showing the respective shares of Great Britain and Germany in the import trade of Russia in gold roubles in various years. The figures are as follows:—

Russian Imports in Gold Roubles.

Year.	From England.	From Germany.
1913	173,000,000	652,000,000
1918	17,873,000	385,000
1920	7,513,000	7,766,000
1921	64,935,000	54,891,000

The values for 1921 do not include food products sent from England for the relief of starving inhabitants. Definite statistics are not available for the first half of 1922, but it is assumed that the ratio of English to German trade was 25 to 8.

Swiss Manufacturers' Troubles.—The annual report for 1921 of the Swiss Association of Commerce and Industry contains some highly interesting information regarding conditions in the engineering business in Switzerland. Her export trade naturally suffered owing to the high value of her franc, and a crisis developed, which reached its culminating point last year. Her difficulties were accentuated by the imposition of high duties in most foreign markets, by the diminishing purchasing capacity of her own population, and by the growth of competition from abroad, particularly from Germany. The number of workpeople employed by members of the Machine Builders' Association fell from 50,610 at the end of 1920 to 41,217 at the end of 1921. Comparing the latter figure with the number employed before the war there is, however, a decrease of only 770 hands.

The total exports of machinery parts and vehicles, which rose from 601,000 metric quintals, valued at 115,082,000 fr. in 1913, to 700,800 metric quintals, valued at 302,273,000 fr. in 1920, fell to 515,300 metric quintals, valued at 240,240,000 fr. in 1921.

Some of the more noteworthy items of export are shown in the following comparative table:—

	(Metric quintals)			Difference in 1921
	1913	1920	1921	from 1920.
Steam boilers	20,543	29,086	20,841	− 8,245
Steam and electric locomotives	9,793	11,982	11,170	− 812
Spinning machinery ...	13,047	22,884	23,145	+ 261
Weaving machinery	66,842	76,078	62,629	−13,449
Dynamo-electric machinery...	79,363	66,574	71,543	+ 4,969
Milling machinery	69,703	58,932	35,954	−22,978
Hydraulic engines	49,385	37,372	55,739	+18,367
Steam engines and turbines	55,946	32,491	38,521	+ 6,030
Internal combustion engines	63,720	76,675	47,695	−28,980

It is expected that the 1922 figures will show decreases all round.

Satisfaction is expressed in the report at the orders for steam turbines which were obtained from abroad, due, it is claimed, to favourable steam consumption guarantees. Locomotive builders were fortunate in having a fairly large number of uncompleted contracts on their books. Thanks to these and to work for the State railways, they were busy most of the year.

In the report of the Chamber of Commerce at Basle it is pointed out that whilst the cost of raw material fell continuously, the prices at which it was possible to dispose of electrical machines fell more in proportion. Manufacturers worked for stock as long as they could, and the Government helped matters by hastening the electrification of the State railways, but it was impossible to avert a crisis. Business in insulating material has varied. In low-pressure goods there has been a slump, but the makers of high-pressure material have been working busily at a satisfactory profit. Anxiety is, however, felt regarding the future, particularly on account of the lack of business in neighbouring countries, due largely to tariff barriers.

The Austrian Glow Lamp Industry.—The present position of the Austrian glow lamp industry is the subject of consideration in a recent issue of the *Handelsmuseum*. Says the journal:—The Austrian glow lamp industry, like other industries, suffers from the currency variations, the conditions of labour, and, not least, from the customs policy of the victorious States, as it is especially directed against exports. The procurement of raw materials from abroad is, furthermore, exceedingly difficult, owing to the steady depreciation of the Austrian krone. The volume of the home market is small in comparison. In Vienna at the end of April, 1922, the number of 500-watt glow lamps affixed to the network of the city's electricity works totalled only some 2.8 million. Reckoning a single change of the lamps in use on the Vienna network, this gives, since the Austrian industry turns out 27,000,000 a year, about one quarter only of the total sales taken by the home market. To this total of sales, German and Hungarian firms having branch houses contribute one fifth, so that the home production outlet is still further restricted by this amount. The export of the rest is rendered difficult by protective tariffs of other countries, which are either much higher than the price of the lamps, or are so high as to be above the cost of the raw materials. Taking Spain, for example, in recent times she has, to the 12 pesetas gold per 1 kg. glow lamp, added a currency impost for Austrian imports which is revised month by month. This has in practice killed the export trade to Spain. The sale price of a 110-volt 10 to 50 c.p. lamp is 1.22 pesetas, the Customs tax to-day is 25.85 pesetas per kilogram. With a weight of 36 g. per lamp, the customs tax, freight, and packing (0.12 pesetas) total 1.08 pesetas, so that for the covering of the cost of production only 0.14 pesetas remains, an amount obviously representing only a fraction of the cost of production. In the case of the export of glow lamps to France, Austria has to pay four times as much tax as either Holland or Switzerland. That France has no need to hinder the exports is shown by the fact that Holland exported thither in the first half of 1921 metal filament lamps up to a weight of 260,000 kg., having a value of 2.4 million gulden. Notwithstanding these extraordinary difficult circumstances, the Austrian glow lamp industry is seeking to keep the home price some 40 per cent. below production cost, the loss thus arising being covered by exports. This will only be possible, however, when the customs difficulties are abolished. If this be not effected, keener labour methods must be resorted to to still further lower the cost of production.

Applications for British Trade Marks.—Appended is a summary of the recent applications for British trade marks in respect of goods and productions connected with the electrical trades and industries. Firms desiring to enter an objection to any of the applications have one month in which to do so from the dates mentioned below:—

Henlex. No. 429,382. Class 5.—Telegraph wire. No. 429,383. Class 8.—Electric cables. W. T. Henley's Telegraph Works Co., Ltd., 13-14, Blomfield Street, London, E.C. November 15th, 1922.

B. & D. The Black and Decker Manufacturing, Baltimore, Md., U.S.A. (lettering and design). No. 425,518. Class 6.—Portable electric drills and parts, electric air compressors, &c. The Black & Decker Manufacturing Co., 600, East Pennsylvania Avenue, Baltimore, U.S.A. (McKenna & Co., 31-4, Basinghall Street, London, E.C.). November 15th, 1922.

Electrads (lettering and design). No. 428,571.—Machinery of all kinds in Class 6. Electrads, Ltd., Evelyn House, 62, Oxford Street, London, W. November 15th, 1922.

Heatrae Electric Fires (lettering and design). No. 428,792. Class 18.—Electric stoves and electric heating and cooking appliances. Electric Fires, Ltd., 147, King Street, Norwich. November 15th, 1922.

Aerolectric. No. 426,514. Class 8.—Apparatus for wireless telegraphy, telephony, and radio instruments and parts. The Æolian Co., Ltd., Æolian Hall, 131-137, New Bond Street, London, W. November 15th. 1922.

Macradio. No. 428,512. Class 8.—Apparatus for use in wireless telephony and telegraphy. Alfred MacArthur, 20, Queen's Crescent, London, N.W. November 15th, 1922.

Gegosite. No. 429,113. Class 8.—Instruments and apparatus for use in wireless telephony. The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C. November 15th, 1922.

Film Publicity.—On November 22nd the Cinema Publicity Service, Ltd., exhibited a number of films showing the activities of a number of industrial companies, including automobile manufacturers, at the West End Cinema, Coventry Street, W.1.

Messrs. Goldwyn, Ltd., are taking the advantage offered by a film called "The Invisible Power" to advertise electricity in its domestic applications.

Lantern Slides.—Messrs. Brook, Hirst & Co., Ltd., inform us that they have prepared a selection of lantern slides illustrating their "Safety First" motor-starting panels. These slides, with explanatory notes, will be lent to any lecturer upon application to the firm, and special additions can be made if necessary.

A Russian Electrical Finance Company.—A meeting of the founders of the Electrical Industry Finance Co., at which were present representatives of the Glavelektro, Narkomzen, Elektrostroya, and of a number of co-operative associations, has been held. The statutes of the concern were examined and a board of the founders was appointed which will put the final touches to the statutes and prepare financial issues and the like. It was clearly shown at the meeting that the 500,000 gold roubles capital will be quickly subscribed if certain rights are made to appertain thereto.

LIGHTING AND POWER NOTES.

Accrington.—Extension of Supply.—The Corporation has decided to provide Oswaldtwistle with electricity. There will be 4,600 yd. of distributing main, 1,360 yd. of feeders, and five distribution pillars.

Australasia.—Tasmania.—A new hydro-electric station, with a capacity of 50,000 h.p., was opened at Risdon on November 23rd. This station is the largest in the Southern hemisphere.—*Reuter* (Hobart).

Sydney (N.S.W.).—The Municipal Council has received a letter from the Under Secretary of Public Works stating that the Cabinet has approved of the introduction of a Bill to confer on the Railway Commissioners the necessary powers to enable them to generate and supply electricity and to make the necessary contracts. The Bill has been drafted and the measure will be introduced immediately.

Bathurst (N.S.W.).—The Council is applying for a loan of £40,000 for the purpose of an electric lighting scheme for the district.

Maclean (N.S.W.).—The Municipal Council is applying for a loan of £7,000 for the purpose of installing electric light within the municipality.

Barnes.—Loan Sanctioned.—The Council has received sanction from the Electricity Commissioners to a loan of £17,000 for the installation of a 1,500-kW turbo-generator.

Birmingham.—Price Reductions.—As from the beginning of the March quarter 1923, a reduction in the charges for electricity of ¼d. per kWh is to come into force.

Blackrock (Dublin).—Electricity Extension.—The Irish Free State Ministry of Commerce and Industry has approved the Urban Council's Electric Lighting Extension Order, as amended, intimating that, on compliance with formalities, Parliamentary approval will be sought.

Bury.—Electricity Supply.—The Corporation has been notified that in connection with the proposed bulk supply of electricity to Rochdale, the Electricity Commissioners have decided in favour of the supply being obtained from the Lancashire Electric Power Co. in preference to Bury.

Crompton.—Special Order.—The District Council is applying to the Electricity Commissioners for a Special Order authorising the Council to supply electricity within the district in accordance with the agreement entered into with the Oldham Corporation.

Canada.—Toronto.—The deal, whereby Toronto acquires the Mackenzie interests, power and radial, has been concluded, the consideration being $32,734,000. The Hydro Commission thus obtains the assets of the Electric Development Co., the Toronto Power Co., the Toronto & Niagara Power Co., the Toronto Electric Light Co., the Toronto and York Radial Railway Co., and the Aurora and Schomberg Railway Co. The directors of all these companies have resigned and a new board has been appointed on the nomination of the Hydro-Electric Commission, under the terms of the agreement, to administer each of these companies. The new board consists of the following: Sir Adam Beck, chairman of the Ontario Hydro-Electric Power Commission, president; Col. D. Carmichael, vice-president; Mr. W. W. Pope, secretary; Mr. F. A. Gaby, chief engineer of the Hydro-Electric Power Commission, a director; and Mr. J. W. Wilmour, treasurer.—*Reuter's Trade Service* (Toronto).

Cardiff.—Year's Working.—The annual statement of accounts of the municipal electricity department (engineer: Mr. Morley New) shows that the capital expenditure during the year was £47,776. The income was £168,370 for the year, an increase of £7,473. Working expenditure amounted to £117,404, an increase of £8,295. The gross profit was thus £50,966, a decrease of £823. Loan charges for the year increased by £19,255 to £43,930, leaving a net surplus of £21,517, a decrease of £2,194. Charges for the year were reduced from 90 per cent. above pre-war rate to 75 per cent., the average rate for the year being 82½ per cent. higher than in 1913. This reduction was offset by increased sales. The output was increased by 1,344,662 kWh to 11,967,013 kWh, principally due to power and heating demands. The output generally was affected by the stoppage of the collieries. Traction supplies are not included in the figures given. There were 1,044 new consumers, 17 miles of feeder and distributor cables were laid, and 5¼ miles of service cables.

Proposed Extensions.—Mr. Morley New recently submitted a report on electricity supply in the added areas. There were 1,000 new consumers available, but while the Corporation system could be immediately extended on the west side of the Taff, the electricity supplies in the added areas on the east side up to 150,000 kWh per annum would have to be taken from the South Wales Power Co. The present consumption in the added areas was about 25,000 kWh. The South Wales Power Co. retained its full powers in the added areas, which meant that the Corporation would be in competition. Mr. New recommended that supplies be established in Llandaff at an estimated cost of £2,600; in Ely at a cost of £1,375; that the present overhead system in Gabalfa be restricted wherever practicable, and that the underground system of mains be adopted. The question of supplies for Llanishen was deferred. These reports were adopted, and it was agreed to make an application for the borrowing of £5,000 for expenditure on substations.

Ceylon.—Reorganisation of Distribution.—In order to overcome the large voltage drop in outlying districts entailed by the present system of distribution, the Kandy municipal electricity department proposes to establish feeding points at six places in the outskirts of the area of supply to which untapped cables will be laid from the power station.

Continental.—France.—Application has been made by a syndicate representing eight communes in the department of the Basses Alpes, including that of Saint Maime, for sanction to construct a network to supply the communes concerned with electricity.

The Société des Forces Motrices de la Vienne has applied for a concession to set up a network to supply electricity to a number of communes in the departments of Vienne and Charente. The current distributed will be alternating, three-phase, at 50 cycles and a pressure of 15,000 volts.

Turkey.—According to the report of the Société Ottomane d'Electricité for last year, the company is now supplying electricity to 24,658 consumers, an increase of 4,451 during the 12 months. The length of the distributing mains has also been increased from 297 to 335 kilometres. A new 10,000-kW steam turbine and generator is being erected at the central station, while, in order to meet the increasing demand, a contract has been placed for a further set of the same capacity to be ready for the 1923-24 winter season.

Dumfries.—Special Order.—The Town Council has been granted an Order authorising it to supply electricity within the borough, and also in the Borough of Maxwelltown.

Dunstable.—Electricity Supply.—The Urban Council has decided to approach Luton Town Council with a view to obtaining a supply of electricity for the town.

Hoylake and West Kirby.—Price Reductions.—The Urban Council has decided to reduce the charge for electricity by 1d. per kWh for the first 500 kWh, and ½d. per kWh beyond, as from January next.

India.—Burma.—An extensive scheme is in contemplation for the supply of electricity to Burma. It is proposed to divert the waters of the Yunzalin river down a slope and through tunnels, thereby supplying the motive power for the generation of electricity for transmission to Rangoon.—*Reuter's Trade Service* (Bombay).

Kilkenny.—Electricity Scheme.—The Corporation has accepted the proposal of Mr. F. Walsh to light the town by electricity. The new system is expected to be in operation in two or three months.

Llandudno.—Price Reduction.—The Council has decided to reduce the price of electricity from 10d. to 8d. per kWh.

Nottingham.—Extension of Supply.—In a Bill which is to be promoted in the ensuing Session of Parliament, the Nottingham Corporation is seeking powers to extend its area of suuply, to include Hucknall Torkard, Radcliffe-on-Trent, Stapleford, and Toton.

Okehampton.—Purchase of Undertaking.—The Town Council is approaching Mr. G. K. Blatchford with a view to purchasing the electricity undertaking.

Oldham.—Loan Sanctioned.—The Electricity Commissioners have intimated, in connection with the Electricity Committee's application for permission to borrow £70,000 for mains and transformers, that they are prepared to sanction the borrowing of £60,158.

Preston.—Loan Sanctioned.—The Corporation has received the sanction of the Electricity Commissioners to the borrowing of £250,000 for plant for the new power station.

Queenstown.—Damage to Electricity Works.—The power station was broken into some time about midnight on November 22nd, and the plant has been completely put out of action. Entering the station early the following morning the chief engineer found that engines and generators were seriously damaged. There was evidence that heavy hammers had been used on the commutators, some of which had been damaged beyond repair.

Rawmarsh.—Electricity Supply.—The Urban Council has under consideration a proposal to obtain a supply of electricity from the Rotherham Corporation.

Selby (Yorks.).—ELECTRICITY SUPPLY.—The Selby Portholme Mills have been secured by the Electrical Distribution of Yorkshire, Ltd., to serve as a distributing station for the district.

Skipton.—SUPPLY FROM KEIGHLEY.—At the November meeting of the Town Council a letter was received from the Electricity Commissioners stating that Keighley Corporation had agreed to supply electricity in bulk to the Yorkshire Electric Power Co., at Eastburn, for transmission to Skipton. The Commissioners undertook to do all in their power to expedite the completion of the necessary arrangements in order that there should be no further delay in providing the power so urgently needed.

Silverton (Somerset).—ELECTRICITY SUPPLY.—A proposal to light the district by electricity has been so well received that immediate operations to carry out the project are proposed.

Waltham Abbey.—ELECTRICITY SUPPLY.—The North Metropolitan Electric Supply Co. has informed the Urban Council of its intention to extend its supply of electricity to the district partly by underground and partly by overhead cables.

TRAMWAY AND RAILWAY NOTES.

Belfast.—REDUCED FARES.—At a recent meeting of the Corporation, a recommendation from the Tramway Committee for reducing the present minimum three-halfpenny fare to one penny was approved.

Canada.—ONTARIO.—The Provincial Government is considering plans for the electrification of the Temiskaming and Northern Ontario Railway at a cost of approximately $9,000,000. It is contended that, with the enormous water powers in the Northland, the substitution of electric power for steam power would effect a considerable saving. It is understood that the Provincial Ministers are favourable to the project and that the Lieutenant-Governor-in-Council will direct that the change be made.—*Reuter's Trade Service* (Toronto).

Continental.—SPAIN.—The Council of Ministers has approved the project of electrification of the line from Rivas to Puigcerdá, the trans-Pyrenean line built by the State. The officers of this railway are at Bilbao. Particulars may be obtained from Señor Don Ramón Lontagut, Ingeniero Jefe de la Segunda División de Ferrocarriles, Balmes 32, Barcelona.—*Reuter's Trade Service* (Madrid).

London.—"UNDERGROUND" EXTENSIONS.—The long-contemplated branch of the Metropolitan Railway from Sandy Lodge to Watford is to be commenced shortly, a contract for the work having been awarded to Messrs. Logan & Hemington, a Doncaster firm. The extension entails two miles of track and three new stations—Watford, Watford Golf Links, and Croxley Green. It is expected that the construction will occupy about two years and give employment to large numbers of men.

"UNDERGROUND" FARES.—In the House of Commons on November 27th, Mr. Gilbert asked the Parliamentary Secretary to the Ministry of Transport whether an inquiry was ordered by his department into certain fares charged by the Underground Railways of London; if so, when was the inquiry ordered and commenced; had any Report yet been presented thereon; and, if so, could he state its purport.

Col. Ashley replied that the Rates Advisory Committee was asked on July 27th last to consider and advise the Minister what, if any, modification should be made in the fares charged under the provisions of the London Electric Railways (Fares, &c.), Act, 1920. The Committee advised on October 27th that proposals made to it by the companies for the reduction of ordinary fares, with corresponding reductions in workmen's fares, might reasonably be accepted as sufficiently meeting the circumstances of the case at the present time, and that they should be brought into operation on January 1st next. The companies undertook to bring the reduced ordinary and workmen's fares in question into operation on that date, and they had advertised particulars of the reductions, which included reductions in certain season ticket rates. It had been arranged that the Committee should present a further report in final discharge of its reference in the course of the early months of next year.

The L.C.C. has decided to withdraw the open trailer cars employed on the South London routes, and experiments are being carried out with top-covered cars of larger capacity.

Manchester.—PROPOSED ALTERATION OF ROUTES.—A joint committee in charge of transport and highway interests has proposed a scheme for relieving the congested traffic in the heart of the city by the suspension of certain tramway routes and the alteration of others.

Mexico.—RAILWAY ELECTRIFICATION.—The International General Electric Company has closed a contract for the electrification of thirty miles of track of the Mexican Railway Co., Ltd., between Orizaba and Esperanza, on the main lines between Mexico City and Vera Cruz. The cost of carrying out the work is estimated at between 2,000,000 and 2,500,000 dollars. The electrification of this stretch of road will be the first on a main line steam railway in Mexico.—*Reuter's Trade Service* (New York).

TELEGRAPH AND TELEPHONE NOTES.

Denmark.—TELEPHONE EXTENSIONS.—The Copenhagen Telephone Co. has concluded a 10,000,000 kr. 5 per cent. bond loan with a Copenhagen private bank, repayable in 20 years. There is no public subscription. A further 10,000,000 have been authorised and will probably be raised in a year's time, and possibly a further 20,000,000 two years later. The money is required for extensions and renovations, and more especially for new cables connecting Copenhagen with the provinces.—*Financier.*

France.—RADIO CONTROL OF AIRCRAFT.—In the last few days experiments with an aeroplane flying without a pilot and guided by means of radio telegraphy have been carried out at the Ville-sauvage Aerodrome, Etampes, under the direction of MM. de Marcay, Bouche, and Percheron.

Flights were made without a pilot on November 24th and on the 25th with a pilot in the aeroplane, although he used, instead of the ordinary machinery of steering and engine control, the gyroscopic stabiliser and the steering motors which will eventually be worked by Hertzian waves directed from a station on the ground. A Voisin biplane with a 300-h.p. motor was used, and Capt. Arbanère was the pilot. The experiments are stated to have been very promising.—*The Times.*

EIFFEL TOWER EXTENSIONS.—The power of the radio installation at the Eiffel Tower, from which the meteorological reports are transmitted to the agricultural districts of France, will shortly be increased, says *The Times.*

India.—STROWGER AUTOMATIC TELEPHONES.—Following the example set by the Post and Telegraph Administration of the Indian Government in installing Strowger automatic telephone equipment at Simla, Lahore, and Amritsar, and the successful results obtained thereby, the Bombay Telephone Co. has decided to give its subscribers the benefits of Strowger service also, and will shortly proceed with the installation of equipment to serve a total of 11,000 lines in the City of Bombay. The contract for this equipment has been secured by the Automatic Telephone Manufacturing Co., Ltd., in whose Liverpool factory the whole of the apparatus will be manufactured. It is anticipated that the installation will be completed and the new system ready for the cut-over early in 1924. Bombay is particularly well adapted for the successful exploitation of the Strowger system, no fewer than 62 different languages and dialects being in common use among its population of approximately one million. The proposed total of 11,000 lines will be housed in two exchanges, the present "Central" accommodating immediate equipment for 6,500 lines, and making provision for an ultimate capacity of 15,000. The other exchange, to be known as "Gell Street," will replace a temporary manual exchange which has just been completed at the Northern end of the city, and equipment will be provided there for immediate requirements with 4,500 lines and an ultimate capacity of 15,000. The five-digit system will be adopted and provision made for connection to all long-distance toll lines entering the city. The scheme embraces line switches of the rotary type, together with covered type selectors and connectors. Economies in floor space and cabling will be secured by the adoption of the "Unit" type intermediate distributing frame for the line circuits. Under this arrangement cross connecting frames are mounted on top of the individual units and, whilst affording exactly the same facilities, dispense with the necessity for a separate intermediate distributing frame. Standard selector and repeater trunk boards will be installed, together with power equipment designed to carry the ultimate load except for the batteries which, at the outset, will only be fitted with sufficient plates to provide ampere-hour capacity for immediate requirements.

Ireland.—COMMUNICATION INTERRUPTED.—Telegraphic communication between Dublin and all towns in the south and west of Ireland was suspended on November 28th, the circuits having been cut by irregulars in the early hours of the morning. Communication with Cork was, however, restored during the evening.—*Daily News.*

Italy.—NEW ATLANTIC CABLE.—A preliminary agreement has been concluded between the Italian Government and the Western Union Telegraph Co. for the laying and working of a cable between a station near Rome and one near New York. The Italians will be responsible for the laying and working of the section of the cable between Italy and the Azores, the Western Union Telegraph Co. for the section between the Azores and America. The cable in question will serve not only Italy, but considerable portions of Central Europe and the Near East. This is the first time that Italy has made such a contribution to the telegraphic means of international communication.—*Daily Telegraph.*

Radio Telegraphy.—CRIME DETECTION.—Having in view the probabilities of radio telegraphy in connection with the detection and prevention of crime, the Huddersfield Watch Committee has given permission to the Chief Constable (Capt. J. W. Moore) to install a radio telegraph and telephone set at the Central Police Station.

THE KILMARNOCK ELECTRICITY UNDERTAKING.

RECENT DEVELOPMENTS.

The Kilmarnock Corporation obtained a Provisional Order in 1899 to supply electricity in the Burgh of Kilmarnock. On the advice of Sir Alexander B. W. Kennedy, a power station was erected on the site of the present station in 1904, and the following plant was installed: Four Belliss compound engines working at a pressure of 165 lb., coupled to Dick, Kerr generators having a total capacity of 470 kW. The boiler house contained three Lancashire boilers.

In 1907 a further 275-kW Belliss-Dick, Kerr set was installed, with a water-tube boiler having a steaming capacity of 5,000 lb. per hour; in 1913 a duplicate of the Belliss-Dick, Kerr set was installed, making the total generating capacity of the station 1,030 kW.

From 1904 to 1913 the supply in the Burgh of Kilmarnock was direct current, 3-wire, at a pressure of 480 volts between the outer conductors and 240 volts between the outer and middle wires, and, in addition, there was a d.c. supply for the tramways at a pressure of 500 volts.

The first turbine was installed in March, 1914, and was manufactured by Messrs. James Howden & Sons, of Glasgow, it being of the mixed-pressure type, and was designed so that the exhaust steam from the Belliss engines could be utilised. This turbine was coupled to a Brown, Boveri alternator capable of giving an output of 500 kW at 3,300 volts, 3-phase, 50 cycles, 3,000 r.p.m. In 1914 the first a.c. 3-phase supply was introduced into Kilmarnock.

Owing to the great increase of the load on the station it was found necessary to install further plant, in December, 1914, a 1,500-kW turbo-alternator being installed, together with condensing plant, and a further two boilers capable of evaporating 18,000 lb. of water per hour, while in the pump room a further feed pump was installed.

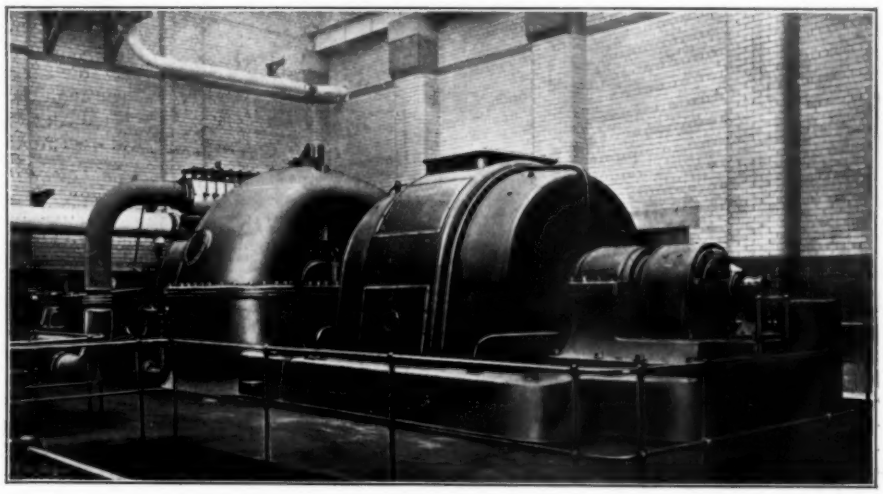


Fig. 1.—A 12,500-kW B.T.H. Turbo-Alternator.

In 1914 the Town Council obtained a Provisional Order to supply outside the Burgh of Kilmarnock, including a large part of Ayrshire and also the following burghs: Troon, Irvine, Galston, Newmilns, and Darvel, for which purpose transmission lines were run across country working at a pressure of 11,000/12,000 volts, a.c., 3-phase, the pressure being reduced by means of static transformers to suit domestic and power purposes in the various burghs.

The supply in the outer district was first available at Hillhouse Quarry in November, 1914. Immediately there was a great demand for electricity, and in order to meet the load a further 2,500-kW turbo-alternator was commissioned in March, 1916, making the total capacity of the station 5,530 kW.

Early in 1917 the whole of the original machinery was sold so that the space it occupied could be utilised for the accommodation of more efficient plant, and by the middle of 1918 a 5,000-kW turbo-alternator was in commission, thus making the capacity of the generating plant 10,000 kW, and two water-tube boilers, each capable of evaporating 20,000 lb. of water per hour, were installed.

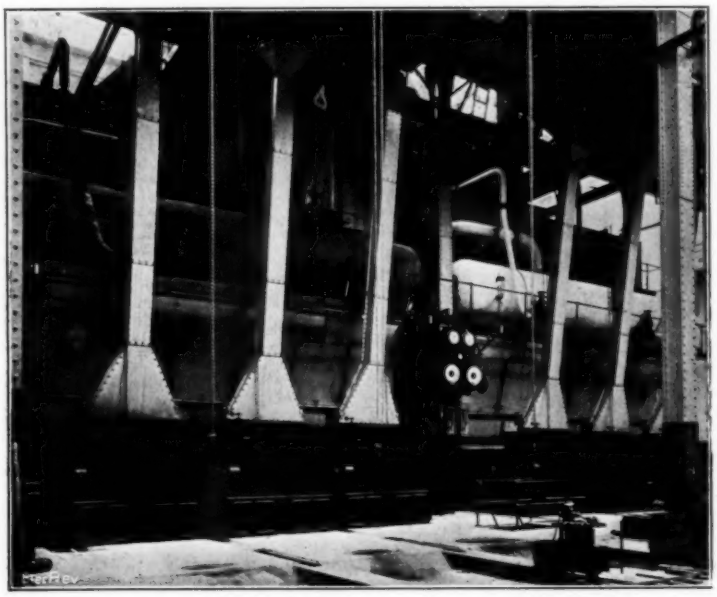


Fig. 2.—Two 50,000-lb. B. & W. Boilers.

Certain large manufacturers made application for a supply of electricity in 1918, but the Corporation, not having the necessary Parliamentary powers to supply these consumers, had to obtain Special Orders to do so. By October, 1919, a transmission line was completed to Ardrossan, and a supply was available

in the Ardrossan Shipyard and Harbour to the extent of 2,000 h.p. The transmission lines were continued to Dalry in 1920, and in 1922 the Corporation again obtained permission to supply 31 parishes and burghs, all in the County of Ayr.

During 1920 it was realised that the capacity of the station was not sufficient to meet the load, should at any time one of the generators be out of commission, and it was decided to practically double the capacity of the whole of the generating plant, which necessitated the building of an almost new station, which was commenced in May, 1920, and is now completed.

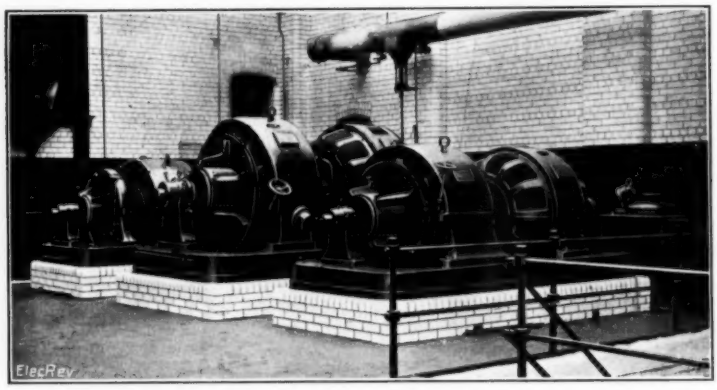


Fig. 3.—Motor Converters.

In the new engine room the following plant is installed: One turbo-alternator running at a speed of 1,500 r.p.m., fig. 1, designed for a steam pressure of 250 lb., superheated 250°. The alternator is capable of giving a continuous output of 12,500 kW at 3,300 volts, 3-phase, 50 cycles. A 50-ton electrically-operated travelling crane has been provided, and in the basement are the necessary condenser and circulating pumps and air filter. The condenser, fig. 4, is capable of dealing with 140,000 lb. of steam per hour in a vacuum of 28½ in. with the barometer at 30 in. The cooling surface is 16,000 sq. ft., and the circulating pump is capable of delivering 735,000 gallons per hour. The rotary combination is driven by a 300-b.h.p. motor running at a speed of 960 r.p.m. The auxiliary plant of the remaining turbines is driven by auxiliary turbines, the exhaust steam of which is used for heating the feed water through a direct contact heater.

In the new boiler house, fig. 2, there are erected two marine type water-tube boilers capable of evaporating 50,000 lb. of water per hour from a feed temperature of 100° F. into steam at 250 lb. per sq. in. The total heating surface of each boiler is 7,445 sq. ft., and above them are the necessary economisers, each having a total heating surface of 5,133 sq. ft., above which are installed the induced-draught fans and chimneys. A considerably increased evaporation can be obtained, however, if a better class of fuel is used, as the boilers are capable of giving the above evaporation when using coal having a calorific value of 8,000 B.th.u. In the basement is the necessary forced-draught plant. The hot air from the alternator is discharged into the fan inlet, thus providing hot air underneath the furnaces.

The coal is brought in trucks along the sidings by the Corporation locomotive, and is then tipped into the coal bunker; from there it is elevated into the storage tanks at the top of the boiler house, and falls by gravity into the hoppers of the boilers. The ashes fall by gravity into hoppers situated in the basement, where they are broken up and then carried by means of suction into a receiver outside the works.

In the pump room are installed two Weir turbine-driven rotary feed pumps, capable of delivering 15,000 gallons of water per hour against a pressure of 325 lb. per sq. in. The exhaust steam from this pump is used for heating the boiler feed water. Suitable recording instruments are provided to check the efficiency of the boiler and generating plant.

The amount of circulating water required for the condensing plant is considerable, and during dry seasons there would have been difficulty in taking this quantity continuously from the river, to overcome which a barrage has been erected across the river immediately outside the works, fig. 5. When the barrage is down, the water, which has already passed through the condensers and been discharged into the river, is dammed back up to the weir. Close to the weir is a pump house, and should at any time there not be sufficient circulating water coming down the river, the water which has been dammed back by the barrage will be pumped again through the condensers.

Amongst the contractors for the new extension were: Turbine and operating switchboard, the British Thomson-Houston Co., Ltd. (which supplied all the other turbine machinery except the 500-kW turbo-alternator); condensing plant, Messrs. Worthington-Simpson, Ltd.; boilers, economisers, suction ash plant, and coal-elevating plant, Messrs. Babcock & Wilcox, Ltd.; barrage, Messrs. Glenfield and Kennedy, Ltd.; Callender's Cable and Construction Co., Ltd., was the successful contractor for the laying of the cables in the original scheme in 1904, and also obtained the contract for practically the whole of the Corporation's cable work. This firm has also erected a large amount of the Corporation's overhead transmission lines on "Kay" towers.

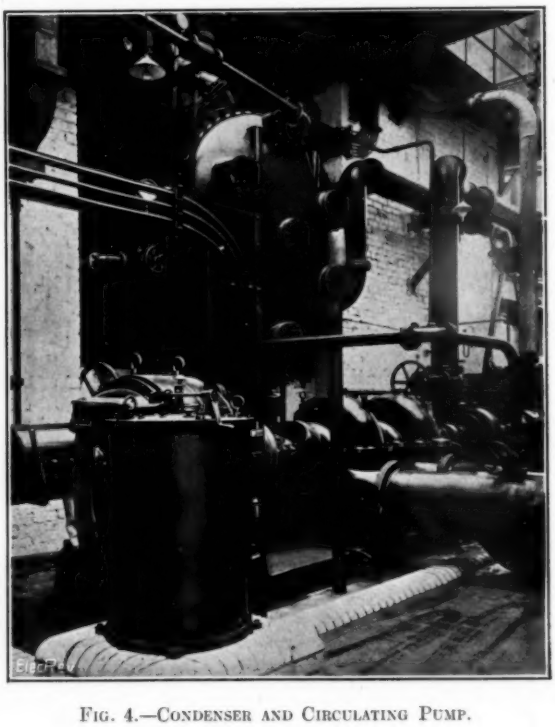


Fig. 4.—Condenser and Circulating Pump.

The whole of the distribution work in the various burghs outside Kilmarnock has been done by the Corporation's own staff.

The Corporation now finds it necessary to increase the pressure of the supply to the outer districts, and recently a transmission line, fig. 6, has been erected to Kilbirnie and is working at 25,000 volts. With a view to saving expense, outdoor sub-stations are now being erected, together with overhead switches.

Mr. W. C. Bexon, the engineer and manager of the undertaking, has some 400 square miles to supply, and has some 80 miles of overhead transmission line working at 11,000 volts, 3-phase, 50 cycles, and also some 20 miles of transmission line working at 25,000 volts. The 11,000-volt transmission lines pass over agricultural land and a number of farms. The Corporation supplies all these farms by means of small pole transformers; altogether some 50 farms use electricity for practically all purposes—lighting, heating and power.

Regarding the outdoor sub-stations, the arrangement is as follows:—The structure is either lattice work or steel girder work. On a six-wire through feeder line both feeders pass through switches, choking coils, lightning arresters and, in some cases, fuses, which are erected in a horizontal position at the top of the sub-station; the open-air switches controlling the transformer are erected in a vertical plane on the side. All the open-air switches are arranged to be operated from the ground by means of a long rod. In a sub-station which has been constructed recently the open-air switches are erected as explained above, but a small building containing oil switches is also erected at the top of the sub-station. The transformers themselves are specially designed for being installed in the open, and some of them are wound in series-parallel so that either 11,00 or 22,000 volts can be obtained. Inside the transformer is the necessary potential transformer, and bolted on the outside case is a voltmeter enclosed in a water-tight cast-iron box. In

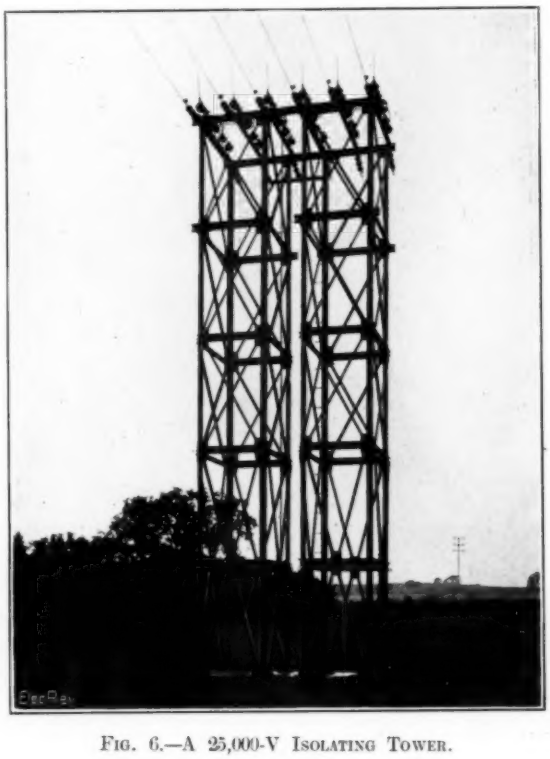


Fig. 6.—A 25,000-V Isolating Tower.

an open-air sub-station where there are two feeders in and out, the arrangement of switching is such that the transformers can be switched into any feeder either on the in-coming or out-going side.

In conclusion, it may be mentioned that the output of the undertaking during the year 1922 amounted to 17,333,660 kWh, the revenue being £103,080, and the total capital expenditure £574,641.

HADFIELD'S "HECLA" STEEL WORKS.

New Rolling-mill Plant.

The Hecla & East Hecla Works at Tinsley and Attercliffe, Sheffield, of Messrs. Hadfields, Ltd., are amongst the most widely known steel-making organisations in the world, and are particularly prominent in the production of special steels. For the purpose of further increasing

Fig. 5.—General View of Barrage.

their facilities there have recently been installed three electrically-driven rolling mills, including a reversing 28-in. blooming and finishing mill and 11-in. and 14-in. bar mills. The two smaller mills are used for rolling billets to the various commercial sizes, and have proved very useful also for the production of special alloy high-tensile steels.

They are of the continuous running bar type, each driven direct by an electric motor having a flywheel and flexible coupling interposed between the motor and the mill. The mills are complete with the usual reeling machines, shears and hot saws, &c., all driven by individual electric motors. A roll-turning department is provided in which are situated electrically-driven lathes and other equipment. Overhead electric travelling cranes handle the raw and finished materials.

The 11-in. mill is arranged with five sets of housings, *i.e.*, one three-high and four two-high, driven by a 400-800-h.p. compound interpole motor having a rated speed of from 150 to 250 r.p.m. through a totally-enclosed machine-cut double-helical reduction gear to reduce the speed of the mill to a minimum of 110 r.p.m. Interposed between the reduction gear and the motor is a flywheel 10 ft. diameter and weighing 17 tons. A buffer spring flexible coupling connects the motor shaft to the flywheel shaft, and a concentric coupling connects the flywheel shaft to the reduction gear. The starting panel for the motor is of the contactor type. The mill rolls 2½-in. billets to rounds of from 1¼-in. to ½-in. diameter, and to squares of from 1¼ in. to 1 in., also to flats of equivalent section within the capacity of the mill and other special sections as required.

The 14-in. mill is arranged with six sets of housings two-high, driven by a 500/1,000-h.p. compound interpole motor having a rated speed of from 75 to 150 r.p.m., the rolls running at the same speeds. Interposed between the mill and motor is a cast-iron flywheel, 12 ft. diameter, weighing 40 tons. A buffer spring flexible coupling connects the motor shaft to the flywheel shaft. The starting panel for the motor is of the contactor type. This mill rolls 5-in. billets to rounds of from 3-in. to 1-in. diameter and to squares of from 3 in. to 1 in., also to flats from 7 in to 1 in. down, and other special sections as required.

The 28-in. mill with its reversing motor, will roll 1,500 tons of special steel 1¼-ton ingots down to 2½-in. billets per week. The motor is supplied with current on the Ilgner system, is rated at 3,200 h.p., and can deal with a transient peak of about 11,600 h.p.

The steel plant to serve this particular mill is housed

in the adjoining building and comprises open-hearth furnaces, each having a melting capacity of from 28 to 35 tons per charge. The outqut capacity is about 1,200 tons per week. There are also nine electric furnaces of 6-7 tons capacity, and three smaller furnaces. The complete plant has a total melting capacity of about 2,300 tons per week, and was built at a cost of

a constant torque of 125 ton-ft. from standstill to 60 r.p.m. in either direction, and gives a constant horse-power of 3,200 between the speeds of 60 and 120 r.p.m. The overload capacity corresponds to a torque of 453 ton-ft. between standstill and 60 r.p.m.; and 11,600 h.p. between the speeds of 60 and 120 r.p.m.

Fig. 2 illustrates the motor looking at the driving

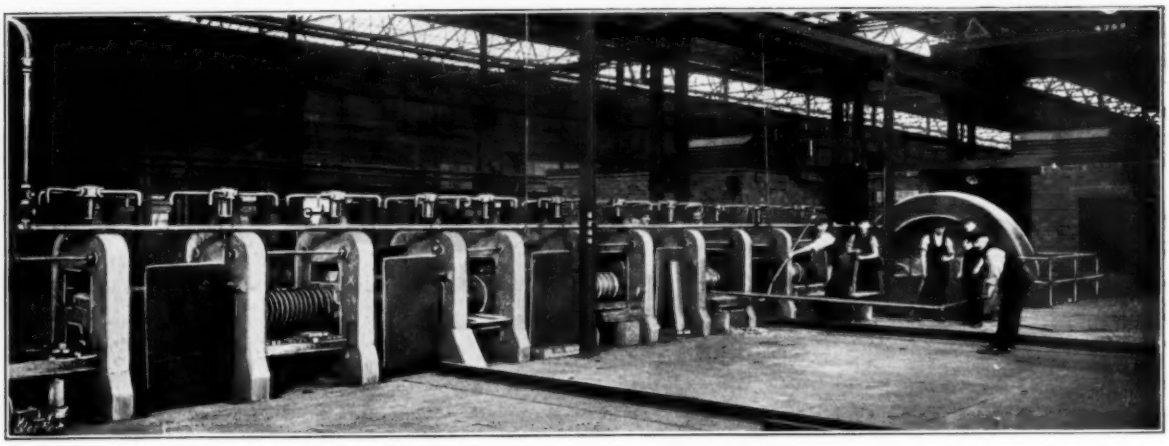


Fig. 1.—Hadfields' 11-in. and 14-in. Rolling Mills.

£260,000. The total output capacity of the Hadfield steel works amounts to over 4,000 tons per week.

The mill plant was constructed by the Brightside Foundry and Engineering Co., Ltd., Sheffield. The electric motor is connected to the bottom pinion by a coupling of the "Ortman" sliding type, constructed entirely of steel, the engaging portions of which are re-

end. The double armature weighs 62 tons and had to be handled by two of the overhead 35-ton cranes.

The motor, which is of the double-armature type, is shunt wound, with compensating windings in the pole faces, and is provided with commutating poles, the two armatures being connected in series for a maximum of 1,300 volts. Ventilating air for the motor is cooled and

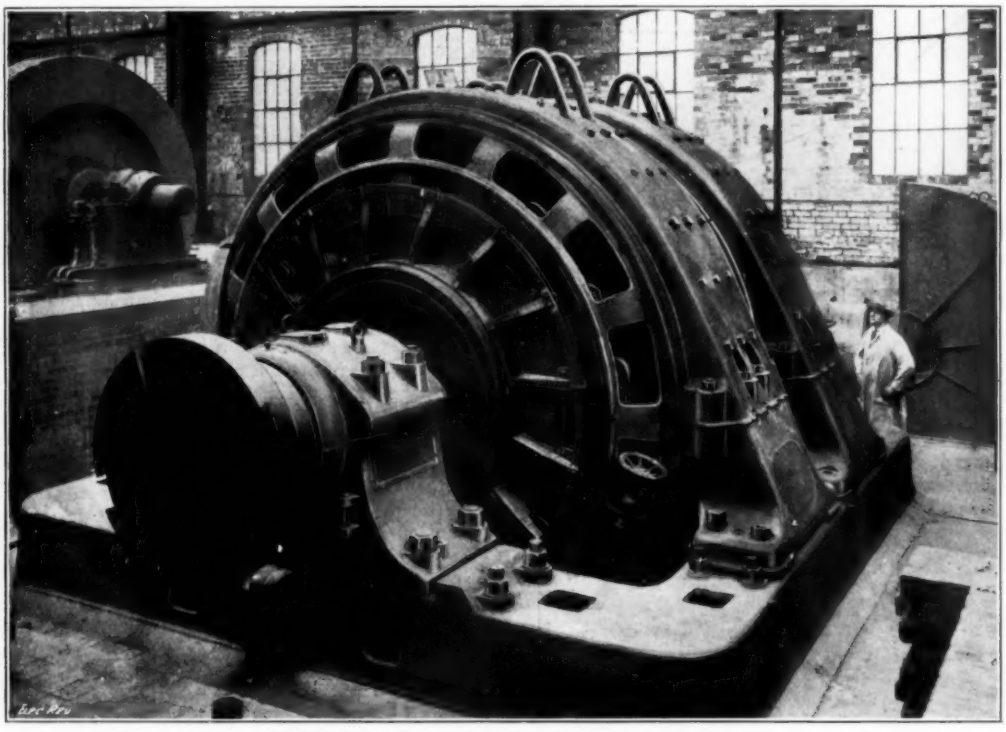


Fig. 2.—A 3,200/11,600-h.p. B.T.H. Motor for 28-in. Reversing Rolling Mill.

newable. It can be engaged or disengaged by hydraulic gear enabling the motor to be run independently of the mill for testing or other purposes, and the oil for the pinions and bearings is circulated by a motor-driven rotary pump.

The mill motor, built by the British Thomson-Houston Co., Ltd., which has an r.m.s. rating of 3,200 h.p. and a maximum rating of 11,600 h.p., is capable of exerting

cleaned by passing through a wet-air filter of the "Invincible" type capable of dealing with 25,000 cu. ft. of air per minute.

Power is supplied to the motor from a flywheel motor-generator set comprising an induction motor of 1,800 h.p. running at 600 r.p.m. (synchronous speed) at a pressure of 3,300 volts, coupled direct to two shunt-wound compensated generators, each rated at 1,300/

4,750 kW when running at 500/600 r.p.m. at 650 volts. The shaft extension of the outer generator is fitted with a buffer-spring type flexible coupling, connected with a cast-steel flywheel 11 ft. 6 in. diameter and 30 tons in weight.

A water-cooled brake is provided to bring the flywheel to rest quickly in case of emergency. The speed of the flywheel is indicated on two instruments, one located on the main instrument board and the other on the control platform.

The mill motor and generator fields are energised by a three-unit set, which comprises a d.c. motor, mill-motor exciter, and generator excitor. The field windings of the excitors give rapid control of the mill motor, and since all speed variation is obtained by control of exciter fields, only small currents have to be handled, a Ward-Leonard controller mounted on the control platform being used for this purpose.

The power for driving the mill is taken from the Sheffield Corporation mains at 11,200 volts, 50 cycles, 3-phase, and transformed by static transformers to 3,300 volts. The supply to the induction motor is controlled by switchgear of the ironclad drawout-truck type, starting and speed being controlled by a special contactor starting and slip-regulating panel, which makes the starting operation entirely automatic.

The maximum power demanded from the Sheffield Corporation should not exceed from 1,800 to 2,000 h.p., and this only when the flywheel set is required to do more than ordinary running; the main motor is capable of being reversed from full speed in one direction to full speed in the other direction in from three to four seconds. The grand total weight of the mill is about 1,600 tons, and the approximate weight of electrical equipment is 400 tons.

The 11 auxiliary motors for driving the live rollers, skids, and screw-down gear on cogging rolls are all of 40 h.p. running at 500 r.p.m., and of the reversing steelworks type, totally-enclosed, series-wound with commutating poles. They are rated on a basis of one hour's duty and will carry 100 per cent. overload without sparking, and can also be run at still greater overloads without serious sparking. They are all arranged for remote control by means of ironclad totally-enclosed reversing master controllers and control panels of the contactor type, with separate specially-rated protected-grid type resistances.

The master controllers for the motors driving the ingoing and outgoing live rollers of the cogging and finishing mills, also for the screw-down gear for the cogging mill, and for the skids between the cogging and finishing mills, are all situated on the main control platform; whereas, for the run-out live rollers to the hot saw and beyond, also for the hot saw and the skids at the cooling bank, the controllers are fixed on separate platforms.

An electric telegraph system is established between the control platform and the electrical equipment house, by which orders may be communicated between the mill-driver on the platform and the attendant in the electrical equipment house, and *vice-versa*.

Decimal Coinage and Metric Weights and Measures.—At the annual meeting of the Decimal Association on November 23rd, the President, Sir Richard Gregory, D.Sc., F.R.A.S., remarked that the use of the metric system was now obligatory in 46 countries; Japan was the latest addition to the list. Until we in this country adopted this universal language of quantity we should continue to be handicapped in comparison with our competitors for the trade of the world. The metric system was used in the electrical industry, in radio communication and broadcasting, in aviation and in international athletics by the whole world, and only this country and the United States still retained the old measures in use for other purposes. The policy of the Executive Committee which advocated the "10-penny shilling" for the purpose of arriving at a decimal coinage without altering a single coin (merely increasing the value of the penny by 20 per cent.) was unanimously approved.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Abertillery.—December 15th. Electricity Department. One 2,200-V, h.p., feeder, one 200-kW and one 30-kW converting sets; h. and l.p. switchgear; static transformers and l.p. switchgear; a.c. overhead and underground distributing system. (November 24th.)

Atherton.—December 20th. Urban District Council. Two 30-kVA, single-phase transformers and one 150-kVA ditto. (See this issue.)

Australia.—Perth.—January 17th. Postmaster-General's Department. Telephone and telegraph apparatus, testing instruments, and protective apparatus.*

Belgium. — December 6th. Belgian State Railway authorities at La Salle Madeleine, Brussels. Rotary converter set and a switchboard at the signalling sub-station at Ghent-St. Pierre, and a switchboard at the signalling sub-station at Denderleeuw.

December 11th. Municipal Council of Schaerbeek, near Brussels. 1,100 dividing boxes, 100 junction boxes, and 1,000 5-amp. single-phase electricity meters. Specification from the Service de l'Electricité, Hôtel Communal, Schaerbeek.

Belgian Congo.—February 10th. Belgian Ministry of the Colonies, 20, Rue de Namur, Brussels. For system of distribution of electrical energy at Stanley Pool, Kasai, in the Belgian Congo.

Bolton-upon-Dearne.—December 21st. Dearne District Light Railways Committee. Construction and equipment of the Dearne District Light Railways.—Rails and fishplates; points and crossings; permanent way, road widenings, and bridge works; overhead line equipment; feeder cables; sub-station plant; rolling stock; buildings. (See this issue.)

Edinburgh.—December 4th. Electricity Supply Department. One 500-kW converting set. (November 17th.)

France.—Paris.—December 11th. Post and Telegraph Department. Supply of metallic filament lamps for one year. Service Central du Matériel des P.T.T., 75, Boulevard Boune, Paris.

Glasgow.—December 5th. Corporation. Electric lighting installation in connection with the Moss Park housing scheme. City Electrical Engineer, 75, Waterloo Street.

Headington, near Oxford.—December 9th. Board of Guardians. Installation of electric lighting in the infirmaries, &c. (November 24th.)

India.—January 9th. Great Indian and Peninsular Railway Co. Electrification of Bombay suburban lines: Electrical equipment of coaches, overhead equipment of permanent way, and overhead distribution lines. (November 17th.)

Leeds.—December 8th. Board of Guardians. Switchboard for private telephone installation at the Lodge of the Institutions, Beckett Street. Particulars from the Master of the Institution. J. H. Ford, clerk to Board of Guardians, Poor Law Offices, South Parade, Leeds.

London.—Barking.—December 19th. County of London Electric Supply Co., Ltd. Water-tube boilers for the Barking power station. (November 24th.)

Long Eaton.—December 11th. Electricity Department. Storage battery, 3-wire booster, switchboard, and steel platform. (See this issue.)

Manchester.—December 4th. Electricity Committee. Two 2,500-kW, one 1,500-kW, and one 1,000-kW rotary converters, with static transformers; or, alternatively, motor converters, with switchgear, l.p. transformer, &c. Four 500-kW automatically-controlled rotary converters and static transformers; or, alternatively, motor converters, complete with the necessary switchgear and full automatic equipment. (November 17th.)

New Zealand.—Wellington.—January 30th. Posts and Telegraph Department. 2,000 g.i. earth rods, 5 ft. x ¾ in.*

South Africa.—Malmesbury.—January 26th. Municipal Council. Electric lighting plant, including two 75-kW d.c. units, boilers, poles, battery, &c.*

St. Helier, Jersey.—Parish Assembly.—Concession for the establishment of an electricity undertaking to supply electrical energy for all public and private purposes within the Parish of St. Helier. (November 24th.)

Torquay.—December 18th. Electricity Committee. Two 400-kW rotary converters and one 300-kW rotary converter, complete with transformers, switchgear, and accessories. (See this issue.)

Warrington.—December 11th. Electricity and Tramways Department. Motors. (November 24th.)

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*A copy of the plan, specification, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Australia.—SYDNEY.—The City Council has reversed its previous decision, and has awarded the contract for the supply of meters to the Electricity Meter Manufacturing Co., of Sydney, the price being £42,906.—*Reuter's Trade Service* (Sydney).

According to the *Sydney Morning Herald*, the Sydney Corporation Electricity Supply Committee declined to consider a tender sent in for what were termed Swiss electricity meters, though the tender was the lowest, the aldermen fearing that the meters were of German manufacture (27s 8d., free of all duty and landing charges; the Customs duty on foreign meters is 45 per cent. and on British meters 35 per cent.). The cheapest British meter was that offered by Noyes Bros., at £1 13s. 4d. The Australian Meter Manufacturing Co. offered meters made in Sydney at 35s. each, or, as an alternative, at the cheapest price quoted for a meter landed in Sydney that complied with the terms of the City Council's specification.

Ald. Courtenay said that this local firm had been supplying the City Council satisfactorily for some years, and if it were driven out of business there would be no more local competition, and the City Council would have to pay much more for the next supply of meters. By four votes to two the Committee decided to recommend the City Council to purchase the meters from the local firm at the price of the British meters. The Council accepted the recommendation.

At a subsequent meeting of the City Council, says the *Sydney Daily Telegraph*, Messrs. Noyes Bros. protested against the acceptance of the alternative tender of the Electricity Meter Manufacturing Co. to supply 5,000 light meters "at the cheapest price quoted for any British meter," stating that their tender was the lowest, and the acceptance of the other tender eliminated fair competition. Mr. Forbes Mackay, general manager of the Electricity Supply Department, reported that the alternative offer should not have been considered. Although he wanted to see the manufacture of meters encouraged, such a precedent would keep good firms from tendering. This was, however, a special case, and it was not the Council's intention to make a practice of considering alternative tender offers.

Blackburn.—Accepted:—

Electric lighting installation at Savoy Picture Theatre, Bolton Road.—Mr. W. Fickup.

Edinburgh.—Corporation. Accepted:—

Fifty-six double-decked cars (£40,000).—Leeds Forge Co., Ltd. This was the lowest tender, others submitted ranging up to £58,000.

Government Contracts.—The following Government contracts were placed during October, 1922:—

ADMIRALTY.—CONTRACT AND PURCHASE DEPARTMENT.

Electrically-driven air compressor.—Alley & MacLellan, Ltd.
Accumulator cells.—Fuller's United Electric Works, Ltd.
Electrodes.—Quasi Arc Co., Ltd.
Electrically-driven ice-making plant.—P. Brotherhood, Ltd.
Switchboard, complete with instruments.—Park Royal Eng. Works, Ltd.
Transformer and switchgear.—General Electric Co., Ltd.
Control valve panels.—MacTaggart, Scott & Co., Ltd.
Motor-driven circulating pumps.—Rees Roturbo Manufacturing Co., Ltd.

WAR OFFICE.

Secondary batteries.—Pritchett & Gold and E.P.S. Co., Ltd.
Electric wire.—British Insulated & Helsby Cables, Ltd.

CROWN AGENTS FOR THE COLONIES.

Batteries.—D.P. Battery Co., Ltd.
Porcelain insulators, &c.—Taylor, Tunnicliffe & Co., Ltd.
Telephone apparatus.—Western Electric Co., Ltd.
Telephone cable, &c.—Siemens Bros. & Co., Ltd.; Johnson & Phillips, Ltd.
Telephone material.—British L.M. Ericsson Manufacturing Co., Ltd.
Bronze line wire.—T. Bolton & Sons, Ltd.
Copper wire, &c.—Elliott's Metal Co., Ltd.
Wireless apparatus.—Radio Communication Co., Ltd.

AIR MINISTRY.

Ammeters.—Johnson & Phillips, Ltd.
Batteries.—Siemens Bros., Ltd.
Generators.—W. Mackie & Co.; Evershed & Vignoles, Ltd.; and Marconi's Wireless Telegraph Co., Ltd.
Modified T.F. receivers.—Muirhead & Co.
W/t spreaders.—McGruer Hollow Spar Co., Ltd.
Transformers.—W. Mackie & Co.
Transmitters.—H. W. Sullivan.
Transmitter spares.—C. A. Carter & Co., Ltd.
Valves.—General Electric Co., Ltd.; Mullard Radio Valve Co., Ltd.

POST OFFICE.

Telegraph apparatus.—British L.M. Ericsson Manufacturing Co., Ltd.; International Electric Co., Ltd.
Telephone apparatus.—British L.M. Ericsson Manufacturing Co., Ltd.; General Electric Co., Ltd. (Peel-Conner Telephone Works); Siemens Bros. & Co., Ltd.
Testing, protective apparatus, &c.—Phœnix Telephone & Electric Works, Ltd.
Submarine cable.—Telegraph Construction & Maintenance Co., Ltd.
Telegraph and telephone cable.—British Insulated & Helsby Cables, Ltd.; Enfield Ediswan Cable Works, Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Macintosh Cable Co., Ltd.; Pirelli-General Cable Works, Ltd.; Union Cable Co., Ltd.
Loading coils.—Western Electric Co., Ltd.
Cords for telephones.—General Electric Co., Ltd. (Peel-Conner Telephone Works); Phœnix Telegraph & Electric Works, Ltd.; Western Electric Co., Ltd.
Ducts.—Mountford, Phillips & Co. (1920), Ltd.
Steel pipes.—Stewart & Lloyds, Ltd.
Earth plates.—T. & W. Farmiloe, Ltd.
Insulated bronze wire.—Johnson & Phillips, Ltd.
Copper wire.—T. Bolton & Sons, Ltd.; British Insulated & Helsby Cables, Ltd.; Elliott's Metal Co., Ltd.; Enfield Ediswan Cable Works, Ltd.; R. Johnson & Nephew, Ltd.; R. Johnson, Clapham & Morris, Ltd.; Pirelli-General Cable Works, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co. (incorporated with the London Electric Wire Co. and Smiths, Ltd.); J. Wilkes, Son & Mapplebeck, Ltd.
Manufacture, drawing-in, and jointing cable (Manchester-Preston).—Western Electric Co., Ltd.
Rewinding generators (Mount Pleasant sub-station).—English Electric Co., Ltd.
Lifts (Dundee Post Office).—Marryat & Scott, Ltd.
Power plant (Marlborough telephonic repeater station, Taplow).—General Electric Co., Ltd. Sub-contractors for batteries.—Premier Accumulator Co., Ltd. For engines.—Ruston & Hornsby, Ltd.
Telephone exchange equipment (Liverpool (Royal)).—Western Electric Co., Ltd. Sub-contractors for batteries.—D.P. Battery Co., Ltd. For charging and ringing machines.—Crompton & Co.

Kent.—County Council. Accepted:—

Electric lighting and heating installation at the Lenham Sanatorium (£6,134).—Messrs. Cash, London.

London.—BATTERSEA.—Electricity Undertaking Committee. Recommended:—

Two new cubicles, fitted with switches, for dealing with the linking-up mains and for a large coupler switch (£1,342).—General Electric Co., Ltd.

Leyton.—U.D.C. The Council is recommended to seal the following contracts:—

Turbine blading.—English Electric Co., Ltd.
Spare armature.—Lancashire Dynamo and Motor Co., Ltd.

Maidstone.—Board of Guardians. Accepted:—

Telephone installation at the Coxheath Institution.—Mr. Hedley Brown.

FORTHCOMING EVENTS.

Salford Technical and Engineering Association.—Saturday, December 2nd. At the Royal Technical Institute. At 6.30 p.m. Annual general meeting.

Institution of Electrical Engineers.—Informal meeting, Monday, December 4th. At the Institution, Victoria Embankment, W.C. At 7 p.m. Discussion on "An Electrical Installation at a Model Farm," to be opened by Mr. F. A. Sclater.

Thursday, December 7th. At the Institution, Victoria Embankment, W.C. At 6 p.m. Paper on "The Possibilities of Transmission by Underground Cables at 100,000/150,000 V," by Mr. A. M. Taylor.

(Students' Section).—Sunday, December 10th. At 3 p.m. Visit to the City & South London Railway reconstruction works.

(Western Centre).—Monday, December 4th. At the Public Library, Swansea. At 6 p.m. Mr. R. O. Kapp will read the late Dr. G. Kapp's paper on "Improvement of Power Factor."

Royal Society of Arts.—Monday, December 4th. At John Street, Adelphi, W.C. At 8 p.m. Cantor lecture, "Brown Coal and Lignites," by Prof. W. A. Bone, F.R.S.

Institute of Transport.—Monday, December 4th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 5.30 p.m. Paper on "Passenger Transport by Road in Rural Areas," by Mr. S. E. Garcke.

Electrical Society of Glasgow.—Tuesday, December 5th. Paper on "Industrial Illumination by Electrical Energy," by Mr. G. Herbert.

Greenock Association of Electrical Engineers.—Tuesday, December 5th. At 22, West Stewart Street. At 7.45 p.m. Lecture on "Wireless Telegraphy and Broadcasting," by Mr. A. P. M. Fleming.

Roentgen Society.—Tuesday, December 5th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 8.15 p.m. Ordinary meeting.

Institution of Civil Engineers.—Tuesday, December 5th. At the Institution, Great George Street, S.W. At 6 p.m. Paper on "Strengthening of the Floor, &c., of the Forth Bridge," by Mr. W. A. Fraser.

Sheffield Electricity Inquiry.—Tuesday, December 5th. At the Town Hall, Sheffield. At 10.30 a.m. Resumption of Electricity Commissioners' North-East Midlands Electricity District Inquiry.

Northampton Engineering College Engineering Society.—Wednesday, December 6th. At the Northampton Institute, St. John Street, E.C. At 5.30 p.m. Paper on "Oxy-Acetylene Welding," by Capt. D. Richardson.

Association of Consulting Engineers (Incorp.).—Wednesday, December 6th. At St. Stephen's Club, Westminster. At 7 p.m. for 7.30 p.m. Annual dinner.

Industrial League and Council.—Wednesday, December 6th. At Holborn Restaurant, W.C. At 5.15 p.m. Annual general meeting.

Institution of Railway Signal Engineers.—Wednesday, December 6th. At the Institution of Electrical Engineers. Victoria Embankment, W.C. At 3.0 p.m. Paper on "Intermediate Block Signalling," by Mr. C. Carslake.

Chief Technical Assistants' Association.—Thursday, December 7th. Discussion on "Mercury Rectifiers," to be opened by Mr. H. F. J. Thompson.

Chelmsford Engineering Society.—Thursday, December 7th. At the East Anglian Institute of Agriculture. At 7 p.m. Paper on "Wireless and Aircraft," by Capt. P. P. Eckersley.

Edinburgh Electrical Society.—Friday, December 8th. At the Philosophical Institute. At 8 p.m. Paper on "Power Transmission," by Mr. T. Orr.

Physical Society of London.—Friday, December 8th. At the Imperial College of Science, South Kensington, S.W. At 5 p.m. Ordinary scientific meeting.

Institution of Heating and Ventilating Engineers.—Friday, December 8th. At the Engineers' Club, W.C. At 7 p.m. Paper on "Centrifugal Pumps as Applied to Heating Installations," by Prof. A. H. Barker.

Junior Institution of Engineers.—Friday, December 8th. At 39, Victoria Street, S.W. At 7.30 p.m. Lecturette, "The Michell Thrust Bearing," by Mr. J. Ward.

Birmingham and District Electric Club.—Saturday, December 9th. At the Grand Hotel. At 7 p.m. General meeting.

Association of Mining Electrical Engineers (Lothians' Branch).—Saturday, December 9th. At Bathgate. Paper, "A User's Criticism of Design of Electrical Machinery for Collieries," by Mr. E. Cunningham.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

WE have to remind readers that Service Department inquiries should be accompanied by a stamped addressed envelope.

The makers or suppliers of the following are asked for:—

EDOLITE electric torches.
BOWLAND daylight lamps.
TRUMBULL switches.

NOTES.

Railway Electrification.—The Cabinet Committee on Unemployment, of which Sir A. Griffith-Boscawen, Minister of Health, is chairman, met at the House of Commons on November 27th, and formulated proposals which were to be submitted to the Cabinet before being outlined in the House of Commons by the Government in the debate on unemployment yesterday, November 30th.

Work, not doles, is the guiding principle of the present committee, and the encouragement of schemes of work by local authorities and by big corporations, such as railway, electric power, tramway, and water development companies, forms an essential part of the new plans.

In this connection the railway managers were received by the Prime Minister on the 28th to discuss railway electrification and other schemes that would absorb some of the unemployed. Following this meeting Mr. McKenna, chairman of the London Joint City and Midland Bank, and a former Chancellor of the Exchequer, conferred with Mr. Bonar Law. It is understood that interest on the loans needed for putting in hand the work, which is estimated to cost in all between £50,000,000 and £60,000,000, will be guaranteed by the Government.

Electrification, plans for which have been long maturing, and much other necessary work on the trunk railways has been held up pending the amalgamations which come into force at the beginning of the New Year. The following railway schemes have been outlined :—

South-Eastern and Chatham.—Electrification of suburban lines. Scheme A deals with a 15 miles radius, and includes North Kent and Greenwich lines, Dartford loop, main line to Orpington and Bromley North, Crystal Palace and Greenwich Park branches, and Catford loop. This will be put in hand almost at once.

Scheme B, to follow, includes Stroud and outlying portions of the line to Tonbridge, Sevenoaks, and Catherham. Approximate cost of schemes, £5,000,000; 650 miles of track are involved.

London and Brighton.—Electrification of 300 track miles, including main line to Lewes and Brighton. Work in the northern area alone would give employment to 7,600 men for four years. Approximate cost of schemes, from £8,000,000 to £10,000,000.

Great Eastern.—Electrification of routes from Liverpool Street to Enfield, Palace Gates, Chingford, Loughton, Epping, Ongar, and Woolwich, with suburban sections of main lines to Broxbourne and Gidea Park.

London and South-Western.—Electrification of main line to Woking and Guildford, and two routes *via* Oxshott and Effingham Junction to Guildford.

Midland.—Electrification of London, Tilbury, and Southend line to Upminster, and eventually to Tilbury and Southend; also widenings and new lines in conjunction with the Great Eastern between Stepney and Gas Factory Junction.

North-Eastern.—Electrification of main line between York and Newcastle and associated sections.

Great Western.—Electrification of the eastern and western valley lines in Monmouthshire.

The Electrical Trades Benevolent Institution.—At the Festival Dinner on Wednesday last, Sir James Kemnal, presiding, announced that his appeal, together with the collection at the tables, had brought in £857 10s. 3d., making with the existing fund a total of £19,637. The guests numbered about 130.

International Electro-Technical Commission. — At the meetings of the I.E.C. Advisory Committees, which took place in Geneva from November 20th to 26th, a total of 58 delegates were present, representing eleven nations, including Germany, and the subjects dealt with are as follows: (1) rating of electrical machinery; (2) graphical symbols; (3) screw lamp-caps and holders; (4) standard pressures and regulations for overhead transmission. Mr. Roger T. Smith acted as chairman of the British delegation to the Advisory Committee on Rating. After four days' discussion it was agreed eventually to recommend all the National Committees of the I.E.C. to consider the acceptance of the 40 per cent. rating with overload as an additional international standard. We are also informed that good progress has been made in the work of the other advisory committees.

Blind Soldiers as Telephone Operators.—Universal as is the sympathy with the wonderful work accomplished by St. Dunstan's for the men of the Imperial Forces who lost their sight in the war, we are particularly impressed with the business-like lines upon which this organisation has always been conducted. It is St. Dunstan's proud boast that it has made "useful citizens again" of nearly 2,000 war-blinded men. May we direct the attention of employers to the way in which very practical help can be given to St. Dunstan's work at the present moment? Many of St. Dunstan's men have been specially trained as telephone operators, and have filled positions all over the country in this capacity with success. St. Dunstan's always endeavours to secure positions for its men as near their own homes as possible, and we are informed that Manchester, Liverpool, Bristol and London, are the areas in which it is at the moment desired to find positions for them. However, the Secretary of St. Dunstan's After-care Organisation, Inner Circle, Regent's Park, N.W.1., will give every information to firms which may be able to engage a blinded soldier as telephone operator, and thus show them that they are independent wage-earning citizens of the Empire for which they sacrificed so much.

Appointments Vacant.—Representative, capable of interviewing and advising prospective consumers regarding lighting, heating, and cooking (£230), for the Bristol Corporation Electricity Department; charge shift engineer for the Yorkshire Electric Power Co.; second distribution assistant and one installation assistant, for the Newport, Mon., Corporation Electricity Department. (See our advertisement pages to-day.)

"The Gas World"—2,000th Number.—On November 18th our esteemed contemporary *The Gas World* published a special issue to signalise the attainment of its 2,000th number—an achievement upon which we offer our sincere congratulations. The *Gas World* was first published on July 26th, 1884, at a time when there was little collaboration or communication between the gas undertakings; but that condition was gradually altered, largely by the influence of our contemporary. We are glad to express our appreciation of the fair-minded and public-spirited attitude which has always characterised the editorial conduct of the journal; though concerned with an industry which in some respects is in rivalry with that which we serve, it has always commanded our respect and esteem, and it has our best wishes for its continued prosperity and enhanced prestige.

The special issue, which is a remarkably large one, contains numerous portraits of past and present leaders of the industry, and special articles dealing with various aspects of the business and the progress made in 40 years, forming an admirable review of the "gas world" then and now.

The Society of Technical Engineers' Unemployment Insurance Scheme.—This scheme, which has recently been thrown open to the whole membership of the Society, is an extension of a limited scheme which has been in operation for a year in one of the largest branches, namely, Stretford. In this scheme, unlike the Government Insurance Scheme, unemployment benefit is paid not only on loss of salary due to dismissal, but also on loss of salary due to suspension on account of a trade dispute to which the members are not parties, and on partial or complete loss of salary due to absence from work on account of illness or accident.

The total period for which benefit may be paid is limited to 48 weeks; the amount of benefit being reduced to three-quarters of the original amount at the end of the 12th week of unemployment, and to one-half at the end of the twenty-fourth week.

Membership of the scheme is quite voluntary, but is limited to members of the S.T.E., and loss of membership of the S.T.E. entails withdrawal from the scheme. During the preliminary year's working (limited as has been stated to one branch of the Society) the membership was about 160.

Since the scheme was commenced in the middle of the trade depression last year, it was arranged that members of that branch who were already dismissed or under notice should receive benefit during the first six months of the scheme without any qualifying period whatever, so that in some cases members of the S.T.E. received unemployment benefit without having paid a penny into the unemployment funds.

Eleven claims in all were paid during this first year, of which seven were cases of dismissal due to reduction of staff, two were suspensions during the recent lock-out, and two were cases of loss of salary due to prolonged absence from work arising from accident and from illness respectively. The total amount paid out to these eleven members amounted to £362, in two cases payment being only necessary for one week, while the longest period of payment was 6½ months.

The total contributions during the period amounted to £858. Bank interest covered slightly more than the working expenses, so that the balance on the year's working amounted to £497. This balance forms the nucleus of the enlarged scheme for the whole society, the members of Stretford branch agreeing to this balance being applied to this purpose.

The funds of the scheme are quite separate from the funds of the Society of Technical Engineers, and the unemployment insurance scheme has its own trustees.

It should be emphasised that, unlike the Government Insurance Scheme, the only contributions to the funds of the scheme are from its members, and that no contributions are received either from the State or from the employer.

An Electric Totalisator.—The latest development of betting by means of the totalisator is a new electrical installation at the Ellerslie Racecourse, Auckland, New Zealand. It embodies recent improvements in the automatic type of machine, and has a registering capacity of 3,000 bets per minute.—*Daily Mail.*

Sheffield Electricity Inquiry.—The Electricity Commissioners' inquiry with respect to the North-East Midlands Electricity District will be resumed at the Town Hall, Sheffield, on December 5th at 10.30 a.m.

Dinner.—On Saturday last, members of the No. 7 Anti-Aircraft Searchlight Section of the London Electrical Engineers held their annual re-union dinner at the Holborn Restaurant. The following were present: Messrs. F. Childs, R. Collins, E. Moore, H. Thomas, H. Verey, A. W. Martin, E. McCarthy, J. Skeen, and H. Payn. A letter was read from Major H. G. G. Clarke regretting his inability to attend, owing to absence from London, and expressing his appreciation of the Section's work in France, both active and experimental, many of the Section's early experiments later becoming standard practice in the searchlight sections of the Royal Engineers.

Fatality.—On November 24th, Frank Brinkworth, a warehouseman, was killed by his coming into contact with a live rail at Dalston Junction. A train passed over his body before it could be taken from the line.

Lecture.—Mr. E. H. Whysall, M.I.E.E., burgh electrical engineer, Greenock, in a recent lecture to the Paisley Association of Electrical Engineers, dealt with the national aspect of electricity supply. Generally speaking, he said, we might be assured that all things were working together for the good of the electricity supply industry, and that the labours of the Electricity Commissioners were already bearing fruit. Both municipalities and companies had already shown signs of a development of a profitable sort of commercial broadmindedness that was very hopeful for the future. Greenock municipality, for instance, had entered into a contract with a sugar refining company to buy from it electrical energy generated by the steam raised from sugar refining. The proper thing, in his opinion, was for the supply authorities to come to an arrangement with all undertakings of this kind for the purchase of surplus energy.

INSTITUTION NOTES.

The Institution of Electrical Engineers.—Informal Meetings Section.—At the informal meeting held on November 20th, Mr. W. E. Warrilow was in the chair, when Mr. F. J. Pearce opened a discussion on "Electric Light Wiring." He divided his paper into two parts; in the first he reviewed the various systems of wiring that have been in practice and criticised them in detail. In the second switch fittings provided for the more trying conditions such with. He explained the peculiar requirements of installations under these conditions; he did not think the lighting and switch fittings provided for the more trying conditions such as acid and fume-laden atmospheres were as yet all that was required, and suggested improvements, but he gave general approval to a screwed-metal-sheathed cable with heavy brass fittings. The paper was followed by an animated discussion, but no striking improvements were suggested. Some 21 speakers took part in the discussion.

A.M.I.E.E. Examination Results.—The list of successful candidates who sat for the A.M.I.E.E. examination in October, 1922, contains the names of 20 candidates who passed the whole of the examination; five passed Part II only, and two passed Part I only. The list also shows that 67 officers of the Corps of Royal Engineers successfully passed the examination. Results relating to candidates who sat for the examination abroad are to be published later.

Dinner.—Arrangements have been made for members of the Institution to dine together at the Engineers' Club after the ordinary meeting of the Institution to be held on December 7th. The charge per cover will be 5s. 6d. Members wishing to be present at the dinner are requested to send their names to the secretary in advance, either in writing or by telephone.

South-Midland Territorial Centre.—*Annual Dinner.*—On Friday last the annual dinner of the South-Midland Centre was held at the Grand Hotel, Birmingham. Prof. W. Cramp, D.Sc., chairman of the Centre, presided, and there was an exceptionally large attendance, considerably exceeding 200 guests.

Proposing the "Institution of Electrical Engineers," Mr. W. Grant Robinson, M.A., C.V.O., principal of Birmingham University, referred to the importance of the Institution, whose functions were to elevate the status of the profession, to improve the education and training of electrical engineers, and to promote research. The University was profoundly interested in the second and third of these functions; it was promoting research as fully as possible, and recently one of its members, Dr. Aston, had been honoured by the award of one of the Nobel prizes in recognition of his discoveries. Thanks were due to the General Electric Co. for its donation to research in the electrical department. It was the first University to establish a professorial chair in electrical engineering, and would cordially co-operate with the Institution in advancing the interests of that science.

Mr. Frank Gill, O.B.E., president I.E.E., in responding, bore witness to the high esteem in which British scientists were held in the United States, which he had recently visited. The Institution, he said, existed to promote the general advance of electrical science, and he laid special emphasis on the duty of each member to consider what he could do towards that end, rather than what he could get out of the Institution. They should read papers and discuss them, and subscribe for *Science Abstracts*. The Territorial Centres had abundantly demonstrated their usefulness; but London was obviously the right place for the headquarters. The Board of Education had invited the assistance of the Institution in organising a scheme of technical education for the whole country, and he asked the members to help in that work with suggestions and in other ways. For instance, they could afford opportunities for University students to work in their workshops during the vacations. Service to others was the highest motive to which men responded.

Proposing "The City of Birmingham and Electricity Supply," Mr. Austen Chamberlain, M.P., quoted history to show that the present depression was but a repetition of past experience, and as on previous occasions, prosperity would be restored by new industrial developments, for which he looked to the electrical profession. Electricity would play an immense part in the revival and reconstruction of the country, but they should bear in mind that whilst they were electricians they were also citizens, and they should do their duty in that capacity; let them not be so wrapped up in their important work that they had no time to help in guiding their country through these difficult times.

The Lord Mayor, Ald. David Davies, J.P., responded, and eulogising the spirit of those who devoted their lives to public service in Birmingham, he stated that the City had invested four millions sterling in electricity supply, and was determined to meet every demand for power that was made upon it.

Prof. Cramp proposed "Kindred Societies and Guests," and took the opportunity to advocate co-operation and affiliation between the engineering associations. There were too many societies, and he appealed to them to come together.

Mr. Neville Chamberlain, M.P., H.M. Postmaster-General, responded, remarking that no Government department owed so much to the electrical industry as the Post Office. The prosperity of that department depended upon the trade of the country, and he would see that it was not conducted in such a way as to check the development of industry and commerce.

Mr. R. A. Chattock, City electrical engineer, Birmingham, proposed "Electrical Industry," which was going to rejuvenate the world. Electricity supply was a barometer of the country's trade, and the enormous amount of power now taken by manufacturers at industrial centres was an indication of the progress that was being made. In Birmingham during the past three quarters the demand had increased at the rate of 7, 30 and 39 per cent. respectively compared with the previous year, and was till growing. The idea put forward in Mr. Gill's presidential address was taking shape, as a conference was to be held to deal with international telephony.

Mr. Hugo Hirst, chairman of the General Electric Co., responded, claiming that industry was the foundation of all civilisation; it had suffered a severe dislocation, but the worst was over, and business was moving again. If they worked hard, prosperity would soon return. Cheap and efficient transport and communication were prime essentials to progress. Some years ago his company had searched the country for an ideal place to start new works, and found Birmingham the best; now a thriving community had grown up where twenty years ago was a waste, and young engineers stationed all over the world were sending orders home to Birmingham.

A programme of music was performed during the dinner, and the arrangements were thoroughly successful in every way.

Liverpool Sub-Centre.—Professor Miles Walker, D.Sc., read the late Dr. Kapp's paper before the Sub-Centre on November 27th. A very interesting discussion followed the reading of the paper, the following taking part:—Messrs. Hollingsworth, Breach, Higham, Teago, Houghton, Midgly, and Dr. Marchant, Messrs. Prescott, Rettie, and Malpas, and a written contribution from Dr. Wall was read.

Institute of Metals.—The Institute has published an index to the first 25 volumes of its *Journal*. A special offer is made to students as an inducement to join the Institute. Very favourable terms have been arranged for student members, and particulars can be obtained from the Secretary, Mr. G. Shaw Scott, M.Sc., 36, Victoria Street, S.W.1.

Association of Mining Electrical Engineers. — "The Efficient Control of Super-Power Stations, with Special Reference to Heat Balance," was the subject of a paper read by Mr. John Bruce, testing engineer, Glasgow Corporation Electricity Department, to the members of the local branch of the Association of Mining Electrical Engineers at Glasgow on November 18th. The paper dealt with the distribution and destination of the heat units liberated by the combustion of coal. It was thought that with the extended use of oil fuel during the last coal miners' strike many undertakings would be able to supply reliable data concerning the results obtained with that fuel, but the time was too short for conclusive results to be arrived at, as, owing to the very high cost of oil, users were glad to go back to the comparatively cheap coal fuel. After describing the various available methods of furnishing auxiliary power, and at the same time controlling the heat balance, Mr. Bruce said that the results at Dalmarnock compared very favourably with those obtained in super-power station practice in America. Operating figures for similar stations in this country were difficult to obtain, the designers and engineers concerned being ex-

ceptionally conservative in the matter of making public results so far obtained. The figures revealed the efficiencies of the numerous stages between the coal and units generated. —*Glasgow Herald.*

Edinburgh Electrical Society.—On November 24th, Mr. James Walker, A.M.I.E.E., read a paper on "Overhead Transmission," in which he dealt with the survey and lay-out of overhead lines. He described the types of poles, the considerations which affected their selection, and the methods adopted in erection. The line accessories, insulators, guys, arresters, and isolating links, were illustrated. The importance of efficient leading-in and earthing appliances was emphasised. Numerous diagrams and lantern slides were shown.

Chelmsford Engineering Society.—On November 23rd, Mr. W. B. Statham, M.Inst.C.E., read a paper entitled "Industrial Refrigeration and Ice Making." The president (Capt. H. Riall Sankey, C.B.) occupied the chair. The lecturer dealt with machines using ammonia gas, carbonic acid gas, and sulphurous acid, and said that the first was the most extensively used, as the least power was required per ton of ice. There was a great advantage also in the fact that leakage from the ammonia plant could not fail to be detected. The lecture was illustrated with lantern slides showing various kinds of refrigerating and ice-making plant.

Finsbury Technical College Old Students' Association.—Manchester Section.—The second annual general meeting and smoking concert was held on November 24th, at the Grand Hotel, Manchester, Mr. A. P. M. Fleming, C.B.E., the chairman, presiding. A very good attendance was recorded and an excellent programme contributed to the enjoyment of a thoroughly successful meeting. A walk is being arranged early in the New Year and the annual dinner will take place in February. Any old Finsbury students in the Manchester district, desirous of joining should write to the Local Secretary, H. F. Coucher, 74, Victoria Road, Stratford.

Faraday Society.—At the annual general meeting, held on November 20th, the following officers and council were elected to serve for the year 1922-1923:—*President*, Sir Robert Robertson, K.B.E., F.R.S.; *Vice-presidents*, Professor C. H. Desch, Professor F. G. Donnan, C.B.E., F.R.S., Dr. J. A. Harker, F.R.S., Professor T. N. Lowry, C.B.E., F.R.S., W. Murray Morrison, Professor J. R. Partington, Dr. G. Senter; *Treasurer*, Robert L. Mond; *Council*, W. R. Bousfield, K.C., F.R.S., Cosmo Johns, Dr. R. Lessing, Professor W. C. McC. Lewis, Professor J. W. McBain, Dr. H. Moore, C. C. Paterson, Dr. J. N. Pring, Professor A. O. Rankine, Dr. E. K. Rideal.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

The Portrush Urban Council received 34 applications for the post of manager of the electricity supply works, rendered vacant by the resignation of Mr. Greene. Seven applicants were chosen for the short list, and in the result Mr. O. W. P. Elliott, Donaghadee, was appointed.

Mr. George D. Killey, J.P., has been appointed chairman of the Directors of the Liverpool Overhead Railway Co., in place of the late Mr. Harvey C. Woodward, J.P.

Mr. R. W. Dalton, H.M. Trade Commissioner in New Zealand, whose comments on the electrical position in New Zealand we were able to publish in our last issue, has been appointed Senior Trade Commissioner in Canada, in succession to Mr. G. T. Milne, who retires in February.

According to *The Times*, Mr. W. Murray Wilson has been appointed chairman of the La Plata Electric Tramways Co., and Mr. John Adams and Major G. O. S. Pringle directors.

At the Redditch U.D.C. Electricity Works, last week, Mr. R. N. Mayne, the chief engineer and manager, was the recipient of a solid silver inkstand and pair of candlesticks on the occasion of his marriage. Mr. V. F. Bush, chief assistant electrical engineer, made the presentation in the presence of a large gathering of staff and employés.

Mr. H. Stanley Deacon, the managing director of Cryselco, Ltd., is retiring at the close of the year. He has been associated with the company since its inception in 1895, in the old carbon lamp days, and was chairman of the British Carbon Lamp Association prior to the advent of the tungsten filament lamp. He has been personally responsible for the policy of the company for many years, and has successfully steered the business through many difficulties which have assailed the lamp industry. He is a Justice of the Peace for the County of Bedford, a member of the County Council, and chairman of the House Committee of the County Hospital, and intends to devote himself to public work.

The Secretary for Mines has appointed Lt.-Colonel R. A. Thomas, C.B.E., R.A., one of H.M. Inspectors of Explosives, to be an additional member of the Explosives in Mines Research Committee which was recently appointed to inquire into the causes of, and the means of preventing the ignition of firedamp and coal dust by the firing of permitted explosives.

As was briefly announced in our last issue, Sir Philip Nash, K.C.M.G., C.B., managing director of the Leeds Forge Co., Ltd., has been appointed chairman of the Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester, in succession to Mr. J. Annan Bryce, who has retired owing to ill-health. Sir Philip Nash, who was director-general of the traffic branch of the Ministry of Transport up to the time he joined the Leeds Forge Co., Ltd., is a mechanical engineer. He commenced his railway career in 1887 at the Great Northern Railway Co.'s locomotive works, Doncaster, and two years later he entered the service of the East Indian Railway in the locomotive department, being appointed assistant general manager in 1911. In March, 1915, Sir Philip Nash returned to this country, and in the autumn of 1915 was appointed director of the National Filling Factories in the Ministry of Munitions. In the summer of the following year he accompanied Sir Eric Geddes to France to inquire into military transportation in October of that year, and succeeded Sir Eric Geddes as Director-General of Transportation in the following May. Sir Philip Nash became Inspector-General of Transportation of the whole British front on the Continent in March, 1918, and British representative on the Inter-Allied Transportation Council. Sir Philip, who is an officer of St. Maurice and St. Lazarus, Commander of the Legion of Honour, Commander of the Order of Leopold, Grand Officer of the Order of the Crown of Italy, and has the American Distinguished Service Medal, retains his position with the Leeds Forge Co., Ltd.

Photo by [*Vandyk.*

Sir Philip Nash,

Who succeeds Mr. Annan Bryce as Chairman of the Metropolitan-Vickers Electrical Co., Ltd.

St. Pancras Borough Council Electricity Committee has appointed Ald. J. H. Mitchell chairman, and Councillor S. Bolsom deputy chairman, for the ensuing year.

Ald. T. A. Beckett has been appointed chairman, and Councillor E. R. Armfield vice-chairman of Fulham Borough Council Electricity Committee.

The Consolidated Pneumatic Tool Co., Ltd., has appointed Capt. Colpoys C. Walcott, R.N. (Ret.), as its district manager for the Bombay territory. He is on his way out to take up his duties in the place of Mr. Rowland Jones, late district manager, who has unfortunately been ordered home owing to ill-health, and has had to relinquish his post.

Mr. J. D. Jones was the recipient of a suit case, subscribed for by the staff, on leaving Messrs. Sandycroft, Ltd., to take up a position with the English Electric Co., Ltd., in London. The presentation was made by Mr. J. E. Davies (chief of the department).

Preston Corporation Electricity Committee recommends that the appointment of Mr. J. F. SIMPSON be varied by his release from the duties of tramways engineer, and that he devote the whole of his time to the duties of borough electrical engineer, at a salary of £600, with bonus.

Obituary.—MR. J. C. GRIFFITHS.—*The Times* records the death of Mr. J. C. Griffiths, C.V.O., late president of the Institute of Chartered Accountants, who was engaged on behalf of the Electric and International Co. when the Government took over the telegraphs in Great Britain. He acted as advisory accountant, it is said, to most of the telegraph cable companies and was a director of the Western Telegraph Co. Mr. Griffiths was born in 1845.

MR. A. CHURCHILL.—The death is announced of Mr. A. Churchill, who was for 27 years on the engineering staff of the County of London Electric Supply Co., Ltd., by whom he was much appreciated and held in the highest esteem.

Will.—The late Mr. W. F. HAMILTON, K.C., who was a director of the Anglo-Argentine Tramway Co., and many other concerns, left £23,483 gross, and £22,762 net personalty.

NEW COMPANIES REGISTERED.

Marshall Electrical Co., Ltd. (185,795).—Private company. Registered November 17th. Capital, £3,000 in £1 shares (2,300 5 per cent. cum. pref. and 700 ord.). To acquire the business carried on at 50, Marshall Street, W., as the "Marshall Electrical Co.," and to adopt an agreement with W. N. Ibbotson, G. Marr, and Mary A. Bancroft, and to carry on the business of electricians, electrical and mechanical engineers, &c. The directors are:—R. W. L. A. Ham, 24, The Parade, Golders Green, N.W., civil engineer (chairman); W. N. Ibbotson, 50, Marshall Street, W., electrical accessories manufacturer. Registered office: 50, Marshall Street, W.1.

G. F. Barrington & Co., Ltd. (185,816).—Private company. Registered November 17th. Capital, £500 in £1 shares. To adopt an agreement with G. F. Barrington and to carry on the business of manufacturers of, and dealers in all wireless apparatus, electrical appliances, dials, scales, rules, name plates, engineers' tools and machinery, &c. The subscribers (each with one share) are:—A. Cowell, 94, Holland Park Avenue, W.11, contractor; G. F. Barrington, 7, Clifton Road, Twickenham, engineer. C. Raggett signs as director. Registered office: 90, Red Lion Square, Holborn, W.C.1.

Luminograph Co., Ltd. (185,849).—Private company. Registered November 20th. Capital, £1,000 in £1 shares. To carry on the business of proprietors and managers of luminous or electric advertisement signs, "tableau" advertisements, and other contrivances, &c. The first directors are: Tomaso Nattero, 11, Via Cesare Cabello, Genoa, merchant; Guglielmo Nattero, 53a, Shaftesbury Avenue, W.1, advertising agent. Secretary: T. Guist. Registered office: 53a, Shaftesbury Avenue, W.1.

Oxford Wireless Telephony Co., Ltd. (185,879).—Private company. Registered November 21st. Capital, £1,500 in £1 shares. To adopt an agreement with H. Lawley and A. H. Shirley, and to carry on the business of a wireless telephone and telegraph company. The first directors are: H. J. Bradley, 290, Iffley Road, Oxford; J. R. Wilkins, 4, Chalfont Road, Oxford; H. J. Butterfield, 286, Iffley Road, Oxford; H. Lawley, 25, Farndon Road, Oxford; A. H. Shirley, 13, Water Eaton Road, Oxford. Qualification: 1 share. Secretary: H. Lawley. Registered office: 22, Queen Street, Oxford.

Native Lamp Co., Ltd. (185,944).—Private company. Registered November 23rd. Capital, £100 in £1 shares. To adopt an agreement with the General Assets Realisation Co., Ltd., and to carry on the business of manufacturers of and dealers in all kinds of electric lamps and accessories, &c. The first directors are: Mrs. E. Brown, Burwood, Longford Avenue, Stretford, Manchester; J. H. Callow, 10, Park Row, Leeds, solicitor. Secretary: J. H. Fawcett. Registered office: 10, Park Row, Leeds.

Western Wireless Telephones, Ltd. (185,948).—Private company. Registered November 23rd. Capital, £1,000 in £1 shares (750 ordinary and 250 6 per cent. preference). To take over the business of wireless manufacturers and agents carried on by Colley, Marriott & Co., Ltd., at 15, Cheapside, Liverpool. The permanent directors are: E. Emmerson, 39, Ravenswood Avenue, Rock Ferry, Cheshire; A. H. Colley, Bungalow, Plymdale Estate, Bromborough, Cheshire. Qualification: £25. Remuneration as fixed by the company. Secretary: A. H. Colley. Registered office: 41, North John Street, Liverpool.

Wilton Wireless Co., Ltd. (185,892).—Private company. Registered November 21st. Capital, £800 in £1 shares. To carry on the business of manufacturers of and dealers in wireless, telegraphic and telephonic apparatus, goods and appliances, electrical apparatus and accessories, &c. The first directors are: G. H. Moody, 134, Coteford Street, Tooting, S.W.17, wireless engineer; A. J. Oakham, 16, King's Road, Tottenham, N., accountant; W. J. A. Hale, 40, Park Road, Hampton Wick, merchant. Qualification: 10 shares. Solicitors: W. I. Thomas, 33, Chancery Lane, W.C.2.

3B Telephone Manufacturing Co., Ltd. (185,831).—Registered November 18th. Capital, £20,000 in 1s. shares. To carry on the business of mechanical and electrical engineers, manufacturers of and dealers in apparatus and devices for use in connection with telegraphy and telephony with or without wires, &c. The first directors are: Edith M. Russell, 8 and 9, Stephen's Buildings, Gresse Street, Rathbone Place, W.; Elizabeth J. Bedingfield, 8 and 9, Stephen's Buildings, Gresse Street, Rathbone Place, W. Minimum cash subscription, 7 shares. Qualification (except first directors): £50. Registered office: 14, South Hill Park, Hampstead, N.W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

United Kingdom Lighting Trust, Ltd.—A. N. Harper, of Austen Friars House, E.C., was appointed receiver on November 13th, 1922, under powers contained in debentures dated November 12th, 1919.

Lighting, Heating and Power Installation Co., Ltd.—F. S. Burman, of 29, Princess Street, Manchester, was appointed receiver on November 10th, under powers contained in debenture dated June 27th, 1922.

James Keith & Blackman Co., Ltd.—(a) Issue on November 11th, 1922, of £1,600 debentures—part of a series; and (b) satisfaction in full on November 11th, 1922, of first debentures dated December 5th, 1902, September 17th, 1912, and January 6th, 1913, securing £1,500.

Electromobile, Ltd.—Mortgage on certain land and premises in Derby, dated November 3rd, 1922, to secure all moneys due or to become due from company to Bank of Liverpool and Martins not exceeding £1,800.

Exceloid Co., Ltd.—Particulars filed of £200 debentures authorised September 30th, 1922, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Lloyd & Ramsden, Ltd.—Particulars filed of £500 debentures authorised October 18th, 1922, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £250.

Pryco, Ltd.—Particulars filed of £1,000 debentures authorised October 30th, 1922, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £700.

Willesden Electric, Ltd.—Debenture, charged on the company's undertaking and property, present and future, including uncalled capital dated November 16th, 1922, to secure all moneys due or to become due from the company to Lloyd's Bank not exceeding £4,000.

Ozonair, Ltd.—(a) Satisfaction in full on November 17th, 1922, of debenture and second debenture dated June 5th, 1915, and May 9th, 1919, securing £4,000 and £1,000 respectively. (b) Particulars filed of £8,000 debentures authorised June 12th, 1922, charged on the company's undertaking and property, present and future, including uncalled capital (if any), the amount of the present issue being £1,500.

CITY NOTES.

Mexican Light and Power Co.

In the first annual report since 1913, the managing director states that the net earnings since 1917 were:—1917, $5,918,508; 1918, $6,094,461; 1919, $6,698,947; 1920, $7,316,572; and 1921 (after allowing $1,000,000 for depreciation), $3,917,325. The set-back during 1921 is attributable to the failure of the water supply. The balance-sheet as at December 31st, 1921, shows under liabilities:—Accrued bond interest, $5,676,923; accounts payable and accrued charges, $1,220,168; general reserve for depreciation, amortisation of franchises, and other assets, $7,000,547; and profit and loss account, $467,716. On the asset side the capital account stands at a total of $68,134,496, floating assets (including securities at market value $2,155,292, and cash $749,835) amount to $4,885,057, and accounts due by Mexican Governments at face value are shown at $3,240,827.—*The Times.*

Amazon Telegraph Co., Ltd.

For the year ended June 30th, 1922, the gross revenue amounted to £57,308, and the working expenses to £40,233. After providing £5,844 for income tax, £9,702 for debenture interest, £13,145 for the sinking fund, and bringing in the balance of £5,790 brought forward, it has been necessary to transfer £6,000 from the general reserve account to meet the deficit, and there will then remain £173 to be carried forward. Trade on the Amazon has, unfortunately, not shown any improvement during the year. The company's receipts have decreased by a further £5,214, and the directors are again unable to recommend the payment of a dividend. The average rate of exchange for the year was 7¼d. per milreis, compared with 10½d. for the previous year.

Mexico Tramways Co.

The report to December 31st, 1921, states that the last report was issued in 1914. At that time conditions in Mexico had become very disturbed; they soon grew much worse, and the tramway undertaking was seized by the Government, who continued to operate it and take earnings until May, 1919, when the property was returned to the company in a very run-down condition. Since May, 1921, fair progress has been made in rehabilitation of property, and although the estimate of earnings has not been completely realised, operating receipts have been reasonably satisfactory, and to-day the company is, owing to arrangement made with its bondholders, in a safe financial position, with an adequate reserve fund to meet rehabilitation and other expenses. Current interest on first mortgage bonds is being paid regularly, and it is hoped that payment of arrears of interest on first mortgaged bonds can be begun at no distant date. With reference to the seizure of the tramways property by the Mexican Government, a large claim for damages has been filed with the Government, and although no arrangement has yet been reached, it is hoped that ultimately a satisfactory settlement will be arrived at. This may have an important bearing upon arrears of interest on first and second mortgage bonds of the company, for if a substantial sum in cash should be realised the time at which these arrears could be paid could be materially advanced. The directors take this opportunity of acknowledging the fact that, during more recent labour troubles, effective protection, under instructions of the President of Mexico, was given to the company in its endeavours to maintain a proper service of tramways. Another matter which has caused the board considerable anxiety is

what is known as "jitney competition." Jitneys are either small automobiles or small 'buses formed by placing a light body upon a cheap motor chassis, many hundreds of which are operating in Mexico City. Steps are being taken to deal more effectively with this competition, which is a serious matter for the Tramways Co.—*Financial Times.*

Stock Exchange Notices.—Applications have been made to the Committee to allow the following to be officially quoted:—

Shropshire, Worcestershire, and Staffordshire Electric Power.—150,000 6 per cent. cumulative preference shares of £1 each, fully paid, Nos. 450,001 to 600,000. (Special application.)

Dealings in the following securities have been specially allowed by the Committee under Rule 159:—

River Plate Electricity Co., Ltd.—£120 ordinary stock.

The undermentioned have been ordered to be officially quoted:—

Calcutta Electric Supply Corporation.—125,000 ordinary shares of £1 each, fully paid, Nos. 800,001 to 925,000.

River Plate Electricity Co.—£49,573 ordinary stock.

Manx Electric Railway.—The accounts for the year ended September 30th, 1922, show that the gross receipts amount to £64,962 and the expenditure to £40,504, leaving a net profit of £24,457 (compared with £18,081), plus £915 brought forward, making £25,373. Interest on debenture stock, £8,851; interest on second mortgage debentures, £2,025; and first mortgage debenture stock sinking fund, £1,000, leaving £13,497. Preference dividends of 5½ per cent. for the year ended September 30th, 1917, and of 4 per cent. on account of 1918 are paid, leaving £1,128 to be carried forward. The ratio of working expenses to receipts was 62.35 per cent., compared with 70.21 per cent. in the previous year.

Isle of Thanet Tramways & Lighting Co., Ltd.—Total receipts for the year ended September 30th, 1922, were £112,561, against £105,628 in the previous year. Net profit £41,814, against £31,448. Balance available £35,642. The directors propose placing to reserve £10,000 (increasing reserve to £30,000), to credit of permanent way reserve £7,366, to credit of rolling stock reserve £5,000; to write off £1,787 from cost of motor vehicles; and to pay nine months' dividend on preference shares, from July 8th, 1908, to April 8th, 1909, being 3s. 9d. per share; £5,863 being carried forward.

Norwich Electric Tramways Co.—The annual report on working up to June 30th, 1922, shows total receipts £86,147, an increase of £6,332, and total expenditure £72,753, a decrease of £3,127, leaving a net profit of £13,394, which is an increase over the previous year of £9,460. £5,280 is appropriated in payment of a 2 per cent. dividend, subject to income tax; £8,000 is put to reserve account; and £114 is to be carried forward. Car miles run, 1,000,402; passengers carried, 11,857,956; earnings per car mile, 20.67d.; expenses per car mile, 16.82d.; earnings per passenger, 1.72d.

Manila Electric Corporation.—According to the Financial Press, the directors have authorised a distribution of 20 per cent. of common stock to holders of record on December 20th, 1922. The $1,000,000 of stock held in trust for the corporation is to be used for this distribution. A special meeting is to be called forthwith to increase the authorised capital from $6,000,000 to $10,000,000, and if this is approved it is planned that $1,000,000 of common stock will be distributed at an early date. It is expected that the 8 per cent. dividend rate will be maintained on all stock.

Newcastle and District Electric Lighting Co., Ltd.—According to the *Financial Times*, this company has resolved to create £100,000 6½ per cent. third mortgage debentures repayable in 15 years, to enable it to meet the increasing demand for energy. It is proposed to issue £60,000 at present in multiples of £100, and this issue will involve the conversion or repayment of the existing third mortgage debentures amounting to £29,400.

German Capital Increases.—The following augmentations of capital have now been decided upon: Berlin Electrical Undertakings Co., 150,000,000 marks in ordinary shares; Berlin Electric Light & Power Investment Co., 110,000,000 marks in ordinary and preference shares; and the Lorenz Co., 65,000,000 marks in ordinary and preference shares.

An Austrian Dividend.—The Austrian Brown, Boveri Co. reports net profits of 371.62 millions of crowns for 1921-22 and a dividend at the rate of 150 per cent. These figures compare with 8.82 millions and 20 per cent. respectively in the preceding year.

French Thomson-Houston Co.—It is stated that the directors of the Compagnie Thomson-Houston have decided to convene a meeting of the shareholders to authorise an increase in the share capital by one or several issues up to 300,000,000 fr.

National Telewriter Co., Ltd.—The profit for the year ended June, 1922, was £978, increasing the credit balance carried forward to £2,168.

Electric Supply Corporation, Ltd.—Interim dividend at the rate of 6 per cent. per annum, less tax, for the half-year ended June last.

Castner-Kellner Alkali Co., Ltd.—Final dividend of 12 per cent., making 20 per cent. for the year.

Globe Telegraph & Trust Co., Ltd.—Quarterly interim dividend of 5s. per share on the ordinary shares.

Western Telegraph Co., Ltd.—First quarterly dividend of 5s. per share, free of tax, being at the rate of 10 per cent. per annum.

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange markets pursue a placid, not to say a rather dull course. One of the features this week is the appearance of an unusual number of new issues, the promoting houses evidently being wishful to get their ventures launched before the advent of the Christmas season shall act as a further check to investment and speculative enterprise. Most of the newcomers possess a good deal of attraction, as, indeed, it is necessary to give them this in order to secure a favourable reception from the public. Existing securities maintain their prices tolerably well, and the release of the half-yearly interest payments on the 5 per cent. War Loan at the end of this week should have the effect of strengthening the securities in the gilt-edged market, and those which depend upon them.

It is interesting to notice that the 4½ per cent. debenture stocks of the three Tube railway companies are being absorbed in such a manner as to leave comparatively little supply now available. In view of the Government's desire to provide employment during the winter, and the meeting of railway managers called by the Prime Minister, it is expected that electrification and railway work of all kinds will shortly be undertaken, upon a large scale, throughout the country. This would mean fresh issues of stock on lines similar to those adopted by the Central London, City & South London and London Electric railways, so that the investor is not likely to lose the chance of acquiring Government-guaranteed stock at reasonable figures.

The electric railway market is a good one, a feature being the strength of Districts. The price rose 3 to 46½ before any reaction occurred. It is said that people are taking their substantial profits on Metropolitan Consolidated, the price of which is up to 60, and utilising the proceeds for the purchase of Districts. This is likely enough, although the supporters of Metropolitans maintain that the price is likely to go to 70. It is rather curious to notice that Districts at the present price pay little more than 2 per cent. on the money on the basis, of course, of the last declared dividend. Underground Electrics are a little dull; East London remains steady at its improved price of 5.

It is more or less an open secret that the electrification of the South-Eastern Railway will be undertaken by the London Electric Supply Corporation, but the price of Londons has eased off to £3. Those who have followed with any close degree of attention the London company's experience with its Brighton Railway contract may be excused for asking whether the South-Eastern work is likely to bring much more profit than that which has rewarded the company's enterprise in carrying out its Brighton contract. The London Company has for some time past been rather the Cinderella of the group, both as regards dividends and the price of its shares.

The Eastern cable stocks remain on the dull side, and the annual report of the Western Telegraph Co. gives pause to those who were prospective buyers of the securities in this group. For the period just ended, the Western Telegraph Co. took £1,680,000, which is £320,000 less than in the previous year, and a million less than that for the 1919-20 period. Expenses last year were reduced, but in smaller proportion, and the net profit of £447,500 shows a decline of about £160,000 over that of the previous twelve months. The dividend is held at 10 per cent., free of tax, but allocations to reserves, &c., are on a more modest scale than those of a year ago. Westerns, Eastern Extensions and Globe Preference are all down about ¼. Eastern Telegraph ordinary at 188 is 2 points lower. Marconis eased off to 2¼, and the wireless group is somewhat dull, the company's recently issued debenture being 3 premium. Chadburn's (Ship) Telegraph announces a gross profit of £62,600 for the last two years, and the net profit of £18,700 is £4,000 better than that of the preceding two years.

Electricity supply shares, with the exception of Londons, are good throughout. The feature is a rise of 15s. in Brompton ordinary, to £10 per share, in consequence of the proposal to distribute bonus shares, to which reference has already been made here. City of London ordinary rose to 2¼, on confident anticipations that the dividend of 14 per cent. will be increased. Chelseas and Kensingtons are both higher. South Londons have changed hands as high as 91s. Edmundsons improved to 38s. 9d. There is a strong tone about the market as a whole, and proprietors are not selling except where they are obliged to do so.

Anglo-Argentine Tramways first preference hardened to 3⅞ and the second preference hold their improvement at 3¼. There are vague hints as to the possibility of a scheme being formulated in the near future whereby the second preference will receive some kind of scrip by way of clearing-off the arrears of dividend on these shares. Some people may object to the back dividends being met in this way, but it is worth

pointing out that for the company to make a show of prosperity at a time when Socialistic tendencies are rife in the Argentine Republic, might lead to a demand for lower fares and for other facilities. British Columbia Electric stocks exhibit marked strength, the deferred being 4 points higher at 86¼ and the 4½ per cent. debenture stock at 80 showing a similar advance.

Improvement also characterises the list of Mexican Utility issues, the particular feature being a jump of 8½ points in Mexico Tramway 6 per cent. bonds, which has carried the price to 55½. The company's first mortgage debentures are 5½ higher at 81½. Mexican Light and Power common and preferred shares have begun to participate in the strength shown by the Mexico Tramways issues. The companies have recently issued reports, giving figures and information which certainly suggest that, with a more settled government in Mexico, there should be no difficulty in restoring both concerns to profitable conditions. Brazilian Tractions went back to 50.

Babcock & Wilcox gained half-a-crown at 3⅞, but, apart from this, there is no particular movement to be noted amongst manufacturing shares. General Electrics eased off to 17s. Callenders at 2½ are 1/16 down. Siemens stick at 21s. 3d., at which price, however, there are buyers in the market. British Aluminium ordinary remain heavy. The price of rubber, the produce, strengthened to 1s. 1½d. per lb. without bringing about any particular increase in the volume of business transacted in rubber shares. The market keeps firm, but having regard to the substantial rise in prices which took place when the commodity started to improve, it is not surprising that speculative investors should refrain from venturing into the market.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend. 1920.	Dividend. 1921.	Price Nov. 28. 1922.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	12	12	10	+ ¾	£6 0 0
Charing Cross Ordinary	8	9	7¾	—	5 16 2
do. do. do. 4½ Pref.	4½	4½	4	—	5 12 6
Chelsea	6	6	6¾	+ ½	4 9 0
City of London	14	14	24/-	+ 1/8	6 11 9
do. do. 6 per cent. Pref.	6	6	22/-	—	5 4 4
County of London	8	8	1·/-	—	5 11 4
do. do. 6 per cent. Pref.	6	6	1½	—	5 4 4
Kensington Ordinary	9	10	7⅝	+ ⅛	6 7 0
London Electric	2½	4	3	— 1/8	4 0 0
do. do. 6 per cent. Pref.	6	6	5⅛	—	5 17 1
Metropolitan	7	7	6½	—	5 7 8
do. 4½ per cent. Pref.	4½	4½	4	—	5 12 6
St. James' and Pall Mall	12	12	9½	—	6 9 9
South London	7	7	4⅜	—	6 7 10
South Metropolitan Pref.	7	7	1·/-	—	5 18 0
Westminster Ordinary	10	10	7½	—	6 9 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	102	—	5 17 6
do. Def.	1½	34/6	23½	—	6 9 0
Chile Telephone	6	6	6½	—	4 16 0
Cuba Sub. Ord.	7	7	7½	—	8 17 10
Eastern Extension	10	10	19⅛	— ⅛	5 4 7
Eastern Tel. Ord.	10	10	188	—2	5 6 5
Globe Tel. and T. Ord.	10	10	19½	—	5 4 0
do. do. Pref.	6	6	11¼	— ¼	5 7 10
Great Northern Tel.	24	22	28	—	7 17 2
Indo-European	10	10	35½	—	7 1 0
Marconi	25	15	2½	— 1/8	6 13 4
Oriental Telephone Ord.	12	12	2·/6	—	*5 4 0
United R. Plate Tel.	8	8	7⅜	—	*5 16 0
West India and Panama	Nil	Nil	5/-	—	Nil
Western Telegraph	10	10	18¼	— ¼	*5 6 0
Home Rails.					
Central London Ord. Assented	4	4	67	—	5 19 5
Metropolitan	1½	2½	61	+1	3 18 9
do. District	Nil	1	46	+2½	2 3 6
Underground Electric Ordinary	Nil	Nil	3½	+ ⅛	Nil
do. do. "A"	Nil	Nil	7/-	—	Nil
do. do. Income	2	4	87½	—	*4 11 5
Foreign Trams, &c.					
Anglo-Arg. Trams. First Pref.	5½	12½	8⅜	+ ⅛	7 6 9
do. do. 2nd Pref.	Nil	5½	3½	—	7 2 0
do. do. 5 per cent. Deb.	5	5	85½	—	5 17 0
Brazil Tractions	Nil	Nil	50	— ⅛	8 0 0
British Columbia Elec. Rly. Pcc.	5	5	80	—	6 5 0
do. do. Preferred	5	93/-	76½	+1	*6 3 6
do. do. Deferred	9	124/-	86½	+4	*7 3 6
do. do. Deb.	4½	4½	80	+4	5 6 3
Mexico Tram. 5 per cent. Bonds	Nil	Nil	81½	+5½	6 2 8
do. 6 per cent. Bonds	Nil	Nil	55½	+5½	Nil
Mexican Light Common	Nil	Nil	23½	+2	Nil
do. Pref.	Nil	Nil	51½	+2	Nil
do. 1st Bonds.	Nil	5	67½	+2	7 8 2
Manufacturing Companies.					
Babcock & Wilcox	15	16	3⅞	+ ⅛	4 14 8
British Aluminium Ord.	10	5	16/9	—	5 19 5
British Insulated Ord.	15	15	2·/-	—	6 17 0
Callenders	15	15	2½	— 1/16	7 1 2
do. 6½ Pref.	6½	6½	1⅞	—	5 15 7
Crompton Ord.	10	5	15/-	—	6 13 4
Edison-Swan	10	Nil	2/6	—	Nil.
do. do. 5 per cent. Deb.	5	5	64	—	7 16 4
Electric Construction	10	10	1·/-xd	—	7 12 4
English Electric	8	5	15/-	—	6 7 0
do. do. Pref.	6	6	18/3	—	6 8 0
Gen. Elec. Pref.	6½	6½	21/9	—	5 19 6
do. Ord.	10	5	17/0	—6d.	5 17 8
Henley	15	15	2·/-	—	6 11 3
do. 4½ Pref.	4½	4½	4⅜	—	5 2 10
India-Rubber	10	—	12/6	—	—
Met.-Vickers Pref.	8	8	8⅜	—	6 14 9
Siemens Ord.	10	10	1·/-	—	—
Telegraph Con.	20	20	25½	—	*4 13 6

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

Wednesday, November 29th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic per lb.	7d.	½d. dec.
a Ammoniac, Sal per ton	£62	£1 dec.
a Ammonia, Muriate (large crystal) "	£48	...
a Bisulphide of Carbon "	...	...
a Borax... "	£30	...
a Copper Sulphate "	£36 15s.	...
a Potash, Chlorate per lb.	5d. to 5½d.	...
a " Perchlorate "	7½d.	...
a Shellac per cwt.	£17 10s.	...
a Sulphur, Sublimed Flowers "	£9	...
a " Lump "	£7 15s.	...
a Soda, Chlorate per lb.	8½d.	...
a " Crystals per ton	£6	...
a Sodium Bichromate, casks per lb.	5d.	...
METALS, &c.		
b Aluminium, Ingots... per ton	£100	...
b " Wire per lb.	1/9 to 2/6	...
b " Sheet "	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I per ton net	£165	£8 dec.
Grade II " "	£122	...
Grade III " "	£68	£2 dec.
c Brass (rolled metal 2" to 12" basis) per lb.	9½d.	...
c " Tubes (solid drawn) "	11¾d. to 1/-	...
c " Wire, basis "	9½d.	...
c Copper Tubes (solid drawn) "	1/1½	...
c " Bars (best selected) per ton	£96	...
c " Sheet "	£96	...
c " Rod "	£96	...
d " (Electrolytic) Bars "	£69 15s.	30s. dec.
d " " Sheets "	£145 10s.	...
d " " Wire Rods "	£79 15s.	30s. dec.
d " " H.C. Wire per lb.	9½d.	½d. dec.
f Ebonite Rod "	3/6	...
f " Sheet "	2/-	...
g German Silver Wire "	2/6	...
h Gutta-percha, fine "	12/6	...
h India-rubber, Para fine "	1/1	½d. dec.
l Iron Pig (Cleveland Warrants) per ton	92s. 6d.	...
l " Wire, galv. No. 8, F.O. qual. "	£24	...
g Lead, English Pig "	£27 10s.	...
g Mercury per bot.	£11 17s. 6d. to £12	2/6 to 5/- dec.
e Mica (in original cases) small per lb.	3d. to 3/-	...
e " " medium "	4/- to 8/-	...
e " " large "	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings "	1/1	...
p " drawn bars and rods "	1/3	...
p " rolled strip & sheet "	1/2½	...
p " wire "	1/3½	...
o Platinum per oz.	£23	...
d Silicium Bronze Wire per lb.	1/0⅜	½d. dec.
r Steel, Magnet, in bars "	10d.	...
n Tin, Block (English) per ton	£173 10s. to £174	£6 dec.
n " Wire, Nos. 1 to 16 per lb.	8/2	...

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
l Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

The Disintegration of Glowing Tungsten Filaments.—The well-known fact that glowing wires, even of metals having a high melting point, when placed in exhausted bulbs, are gradually disintegrated and deposited on the surrounding walls, has generally been considered as a case of sublimation. The metal is supposed to vaporise at the high temperature and the vapour to be deposited as a metallic coating on the cool glass.

As a result of numerous careful photomicrographs, both of the deposit and of filaments in various stages of disintegration, Mr. A. Goetz has come to a different conclusion.

As is well known, it has not yet been found possible to prepare tungsten filaments from molten metal. They are usually formed of finely powdered crystalline tungsten held together by some binding material. Pure tungsten shows comparatively little power of occluding gases, but the binding material has this power to a much greater degree. When the filament is heated, the occluded gases begin to escape and, if the temperature is raised sufficiently, the gas cannot diffuse quickly enough through the gaps between the crystals, and a very great force is exerted on the already somewhat insecure crystals. The outermost crystals are consequently torn off and forcibly discharged from the filament surface.

The photographs of the deposit show irregularly arranged tungsten splinters, whilst those of the filament show a series of blow-holes which, in some cases, may grow quite large.

The fact that filaments glowing in nitrogen show far less tendency to disintegrate than when in a vacuum is attributed by the writer to the presence of an absorbed surface layer, which is quickly destroyed in a vacuum, whilst it is little, if at all, affected in a gas atmosphere.—*E. T. Z.*

THE "THERMIX" AIR HEATER.

The "Thermix" Air Heater for boiler plant forms the subject of an interesting brochure recently issued by the Emile Prat-Daniel Co., of Paris, through its British representative, Mr. S. Utting, M.I.Mech.E., A.M.I.E.E. The publication is of particular interest at the present time, when, owing to the comparatively high cost of fuel for steam raising purposes, it is necessary to consider very carefully every possible means to improve efficiency and reduce production costs to the lowest practicable figure.

Although M. Emile Prat has devoted some twenty years to the specialised study of combustion matters, and the draught system which bears his name, it is only in recent years that his researches on combustion with preheated air have been brought into prominence through the evolution of the "Thermix" air heater for the recuperation of waste

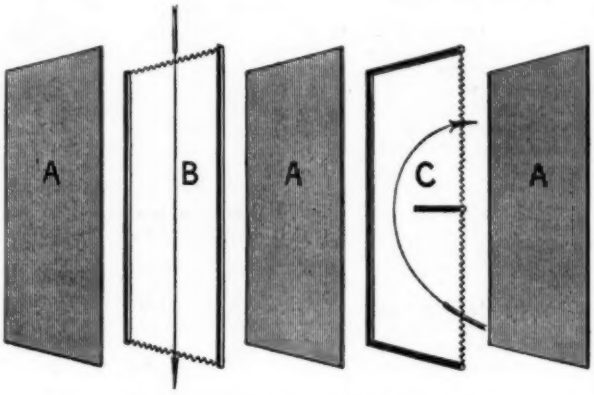

Fig. 1.—Elements of the "Thermix" Air Heater.

heat in furnace gases and the improvement of the combustion process.

Useful notes are given on the subject of chimney gas losses from boiler furnaces, and it is shown that the losses vary directly as the temperature of the gases and inversely as the percentage of carbon dioxide present. A simple formula for the calculation of these losses is given, and assuming a coal of average quality, the sensible heat carried away in the furnace exit gases can be expressed as an approximate percentage of the total heat in the fuel as fired.

It is evident that for efficient working, a high degree of combustion must be attained, and at the same time the chimney loss must be kept down by cooling the gases to the lowest practicable figure and utilising the sensible heat in connection with the boiler plant.

In power plant, this latter desideratum is often partly secured by the adoption of the well-known fuel economiser, which, although quite a satisfactory arrangement in practice, does not generally admit of the maximum heat recuperation possible, whilst in the most modern plant, the developments in high-pressure boilers, steam turbines and feed-water heaters, preclude to an appreciable extent the most efficient use of the economiser heating surface.

The air heater in such cases provides the necessary secondary recuperation, and with the present tendency towards higher steam pressures and temperatures there is a distinct field for the employment of air heaters, apart from the question of the more efficient combustion attainable by the use of preheated air for the furnaces. The principal advantages of the air heater are briefly:—

(1) Good heat recuperation from the gases.
(2) Less weight, less cost, and less space occupied than a corresponding economiser, and a reduction in capital cost of the boiler house.
(3) All air for the furnaces can be preheated, thereby promoting more efficient combustion, particularly with low-grade fuel.
(4) Heated air for industrial purposes is obtained at a cost of almost nil.

These points are discussed in the brochure, and it is interesting to note that an appreciable reduction in capital expenditure on boiler-house plant is possible under modern conditions by the provision of a moderate amount of economiser surface and an air heater, or if the feed water is sufficiently heated by live or exhaust steam, the air heater alone could be installed in many cases.

The use of preheated air for combustion undoubtedly results in an increased boiler efficiency, the flue gases leaving the boiler at a lower temperature than when cold air is supplied to the furnace. The increase of furnace temperature results in more complete combustion of the fuel and a reduction in the excess air supplied, and this is particularly so in the case of low grade fuels which are difficult to burn efficiently in ordinary practice. Tests conducted by the Paris Steam Users' Association on a Belleville boiler, appear to have shown that with the "Thermix" heater in operation an increase of 13 per cent. in thermal efficiency was obtained and the output of the boiler was increased by no less than 16 per cent., whilst the amount of clinker was also reduced when utilising preheated air for combustion. On the Continent, where fuel economy is probably receiving greater attention at the moment than in Great Britain, the use of preheated air is extending, and temperatures up to 300 deg. F. have been successfully utilised in practice up to the present.

The constructional features of air heaters have altered materially of recent years, the usual iron or steel tubular type of heater having unfortunately a rather low coefficient of heat transmission, necessitating large heating surfaces and considerable fan power if high air velocities are adopted. The modern type of steel plate heater possesses important advantages, and the Emile Prat-Daniel Co. has developed the design of heaters which are simple in construction, possess a high coefficient of transmission, and are cheaper in both first cost and maintenance than the older patterns in use.

The "Thermix" heater consists of a number of flat rectangular steel plates about No. 10 B.W.G. in thickness, separated by distance pieces of small channel section joined by steel wire spirals, the whole being grouped in an outer framing of angle iron. The construction of the elements is shown in fig. 1, the steel plates (A) and the distance pieces(B) and (C) being assembled into alternate gas and air elements, the gas passing vertically between the plates and the air circulation being contra-flow on one of the four or more methods of circulation which can be adopted in any specific case to suit the boiler plant. This arrangement enables the heater to be applied to all types of boilers, and possesses the important features of simplicity in construction, ease of extension of heating surface if required, and accessibility for renewals of the plates, although in practice a life of ten years or more can be reasonably anticipated.

The general arrangement of the heater with the elements assembled in the framing is shown in fig. 2, the whole being a sound mechanical job after the clamping bolts in the framing have been screwed up to ensure tight joints between the elements.

In practice, it is found that the heater seldom requires cleaning, unlike an economiser, and this is probably due to the fact that the gas velocity is about six times greater than in an economiser, and also there is an absence of vapour

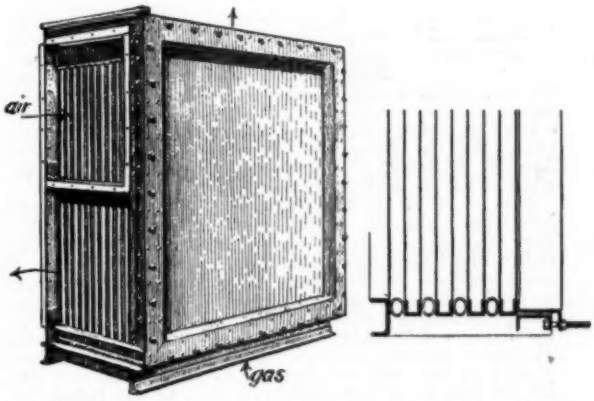

Fig. 2.—General Arrangement of "Thermix" Air Heater.

condensation, the exit gases being usually above a temperature of 130 deg. F. Arrangements are made, however, so that in the event of cleaning being required this can be simply carried out by an acceleration of the gas velocity by moving the damper deflectors.

In many large power houses the combination of an economiser and air heater would prove to be a sound proposition, the capital costs being appreciably reduced and a high thermal efficiency obtained if a suitable disposition of the recuperative surfaces were adopted. This point is explained in the brochure, and a series of curves have been drawn for various temperatures and proportions of heating surfaces.

Data with regard to one or two interesting tests on boilers fitted with "Thermix" heaters are given, but owing to development in the design of large heaters it is rather early as yet to give any definite figures for the important installations which have just been completed.

Illustrations are given of the lay-out of some typical installations, amongst these being that at The Hague electricity works, where chain grate stokers are in use with preheated air and most satisfactory results are being obtained. In conclusion, it is interesting to note that at the Gennevilliers electricity works, near Paris, a combination of economisers and air heaters has been adopted for the fifteen very large boiler units installed.

THE ENGINEERING TRADE OF INDIA.

(WITH ELECTRICAL IMPORT STATISTICS.)

Mr. T. M. Ainscough, H.M. Senior Trade Commissioner in India and Ceylon, has written a very informative report on the conditions and prospects of British trade with India during the fiscal year ending March 31st, 1922. The report has been revised to September last and issued by the Department of Overseas Trade (price 2s. 6d.).

Taken as a whole and without stressing too greatly the possibility of further political troubles, the report reveals a satisfactory position. Notwithstanding the world-wide depression and the peculiar difficulties which have been experienced by British industry during the past year, the Trade Commissioner says that the United Kingdom is maintaining its place in its most valuable overseas market in a remarkable way, which augurs well for the future.

American Competition.

Imports from the United States, which are probably of more concern than any to the engineering world, fell from 10.5 per cent. of the pre-war total to 8.1 per cent. last year, whilst those from Japan fell from 7.9 per cent. to 5.1 per cent. Meanwhile the share of the United Kingdom declined only from 61 to 57 per cent. Machinery and millwork rank second in importance amongst American imports and iron and steel third. The few American merchant houses established in India have suffered as great, if not greater, losses than their British rivals. One of the most powerful, the report says, is winding up its Indian business with a view to cutting its losses, and those firms which conducted a commission indent business with the bazaars have largely spent the year in clearing up their outstanding orders. There is, however, considerable activity on the part of American manufacturers in sending specialists to India, so that they may be organised when trade improves. Mr. Ainscough reports several instances where American technical representatives have been very energetic in studying the wishes of large buyers of plant, and have spared no effort in meeting their special needs. On several occasions he has heard the expression of opinion that American travelling salesmen are frequently more fully conversant with the practical working of their machines and are able to give more valuable advice on technical matters than their British rivals, who are often merely commercial salesmen and not engineers in addition.

Japan and Germany.

It is satisfactory to learn that Japanese competition, except in certain grades of cotton textiles, is no longer a serious factor. Regarding German undercutting in machinery, millwork, and electrical accessories, Mr. Ainscough naturally utters a warning, for the feature was marked during a large part of the period covered by his report. It is now known that the edge of this competition has been blunted by financial difficulties. Whether it will be sharpened again, when and if the mark is stabilised, it is difficult to say.

With regard to future competition of native engineering industries, since Mr. Ainscough's report was completed, a new phase seems likely to begin, judging by the report of the Indian Fiscal Commission, which is frankly protectionist. It is noteworthy in the case of machinery that the original Budget proposal was to increase the import duty from 2½ to 10 per cent., but industrial interests in the Legislative Assembly were too strong, and the proposal fell through. The tariff on power machinery remains, therefore, at 2½ per cent. The increase in that on iron and steel from 2½ to 10 per cent. will give, for the first time, appreciable protection to the Indian iron and steel industry, although it may adversely affect the local engineering industries, which have to rely on imported iron and steel. To the Trade Commissioner it seems regrettable that at a time when India requires such large quantities of structural steel to make good the depreciation during the war and to build up her nascent industries, the cost of steel—the raw material of almost all industries—should be artificially raised as a result of import duties.

£100,000,000 on Railway Work.

Mr. Ainscough thinks that British manufacturers are bound to benefit from the expenditure of £100,000,000 which is proposed on the Indian railways during the next five years. In his view they should be able to secure the bulk of the orders, owing to the fact that they are thoroughly conversant with Indian railway requirements, and have supplied almost the whole of their equipment in the past. Interested firms are recommended to read the section of the report which deals with the changes that are contemplated in the method of purchase of Government stores.

Mr. Ainscough's advice is that, in those cases where the Indian Government normally takes a large share of a company's productions and where manufacture in India shows a reasonable chance of success, British manufacturers should seriously consider the establishment of works in India. The present tendency is all towards the protection and development of India's industries, and with the transfer of more and more power into Indian hands, this tendency will be accentuated. Moreover, there is a danger that unless British makers take their opportunities and move with the times, they will find that their foreign competitors may steal a march on them. India is determined to develop its industries and would welcome foreign enterprise if British capital and energy are not available. This would mean the introduction of foreign standards and practice and would do incalculable harm to our interests.

Machinery and Millwork.

Meanwhile the outstanding feature of the year has been the prodigious import of machinery of all kinds, and this item now takes third place in the import trade, being exceeded only by cotton textiles and sugar. The origin of the imports of machinery and millwork during the past two years is indicated below:—

Countries of consignment.	1920-21. Rupees (lakhs).	1921-22. Rupees (lakhs).
United Kingdom	17,53	28,32
Germany	17	55
Switzerland	3	11
Japan	12	4
United States	4,02	4,51
Other countries	50	72
Total	22,37	34,25

The following table shows the relative importance of the three principal suppliers both before the war and during the past two years:—

Country.	1913-14. per cent.	1920-21. per cent.	1921-22. per cent.
United Kingdom ...	90.0	79	82.5
United States ...	3.0	17	13
Germany	5.5	.75	1.5
Other countries ...	1.5	3.25	3
Total ...	100.0	100.00	100.00

It is most satisfactory to note that, although the United Kingdom has not yet regained her pre-war position, she bids fair to do so in a few years' time, and is recovering ground lost during the war in a remarkable way. Although American shipments have steadily declined in the aggregate, United States competition is still serious in many branches, such as electrical plant, sawmilling and woodworking machinery, agricultural machinery, machine tools, and industrial plant of all kinds. Moreover, by dint of active representation on the spot, she is obtaining a footing in very many lines which have hitherto been supplied by British makers.

During the first quarter of the new fiscal year imports in this class have not been maintained, but declined about 30 per cent. compared with April to June, 1921. Whilst the share of Great Britain and the United States was reduced, that of Germany increased considerably. Taking electrical machinery alone, however, the British share was greater, whilst the American was very much smaller.

Somewhat similar tendencies are shown in the trade in electrical instruments and apparatus. During the 12 months under review, British makers improved their position, the shares of the chief supplying countries being:—United Kingdom, 69.2 per cent.; United States, 22.7 per cent.; Japan, 3 per cent.; Italy, 2 per cent.; and Holland, 1½ per cent. Between April and June this year imports were not maintained: the British share fell more than 50 per cent. and that of America 80 per cent. Italy increased her proportion.

Technical Representation.

Seeing that India's imports of machinery and plant last year totalled £23,000,000 in value, of which nearly £19,000,000 worth was obtained from the United Kingdom, the question of representation is vital. The view which Mr. Ainscough strongly holds is that British engineering manufacturers who already have a large interest in the market should open their own office and selling organisation in the field in those cases where the trade to be gained warrants the expense, and in other cases they should form group-selling organisations in conjunction with other manufacturers of non-competing lines, and the group association should open its own offices in Calcutta and/or Bombay as circumstances direct. The following are a few of the reasons on which Mr. Ainscough bases this opinion:—

The firms of mercantile agents in India, who have in the past held many of the leading machinery agencies, are usually houses of standing who hold the agency of some 10 to 30 British manufacturers of various lines. They frequently act as piece-goods importers, shipping and insurance agents, exporters of all kinds of produce, managing agents of local industries, and conduct a general merchant's business. The numerous machinery agencies are, therefore, relegated to an engineering department staffed by two or three European assistants, with sometimes a qualified mechanical engineer in charge. It is obvious that, with the best will in the world, it is impossible for such a firm to do adequate justice to each of the agencies held. In the case of machinery in general demand in India, the ideal method of representation, from the British manufacturer's point of view, is to have his own office staffed with competent engineers and salesmen and—in

the case of heavy plant—provided with an expert staff of erectors. There are, of course, a few firms who specialise in conducting machinery business and who give their principals good service. In these cases the British manufacturing engineer should attach one of his own men to his agents, to assist them by travelling the country, demonstrating the value of the machines, putting right defects in previous deliveries, advising probable purchasers, and generally promoting his employers' interests.

The Indian industrialist is branching out into many highly complex activities and is determined to have the most highly scientific advice and to purchase the most improved forms of plant obtainable. There are very few firms of consulting engineers in India to-day. The trained managers of the branch offices of home engineering and machinery firms have, in the past, filled this gap. In the future they will be needed more than ever.

Mr. Ainscough also recommends the British engineering manufacturer to maintain an erecting staff in conjunction with his selling and technical organisation.

Hydro-Electric Survey.

Owing to the transfer of the hydro-electric department from the Central to the Provincial Governments as a result of the constitutional reforms, the scheme for a co-ordinated survey of the whole of India has been abandoned. Mr. J. W. Meares, O.I.E., who held the post of Chief Engineer of the Hydro-Electric Survey, and who has been Electrical Adviser to the Government of India for many years, returned from India recently, both the posts he held having been abolished. While it is true that Provincial Governments are themselves, in some cases, appointing committees to consider what steps they should take, it is to be feared that, in most instances, funds will not be forthcoming and that the hydro-electric development of the country will be retarded for many years.

Electrical Imports of India.

The following statistics of the imports of electrical and similar goods into British India in the year ended March 31st, 1921, are taken from the recently-issued official trade returns, details for the year ended March 31st, 1920, being added for purposes of comparison, and notes of any increases and decreases given.

	1919-20 £	1920-21 £	Inc. or dec. £
Control and switchgear—			
Total	*	64,000	—
From United Kingdom ...	—	63,000	—
,, United States	—	1,000	—
Electrical generators—			
Total ...	252,000	451,000	+ 199,000
From United Kingdom ...	189,000	220,000	+ 31,000
,, United States ...	60,000	229,000	+ 169,000
Electric motors—			
Total	344,000	614,000	+ 270,000
From United Kingdom ...	126,000	501,000	+ 375,000
,, United States ...	215,000	96,000	− 119,000
Transformers—			
Total	26,000	43,000	+ 17,000
From United Kingdom ...	4,000	13,000	+ 9,000
,, United States ...	22,000	30,000	+ 8,000
Turbo-generating sets—			
Total	*	89,000	—
From United Kingdom ...	—	87,000	—
,, United States ...	—	2,000	—
Other electrical machinery—			
Total	619,000	927,000	+ 308,000
From United Kingdom ...	244,000	608,000	+ 364,000
,, United States ...	356,000	307,000	− 49,000
,, Italy	4,000	6,000	+ 2,000
,, Switzerland	11,000	—	− 11,000
Mining machinery—			
Total	156,000	298,000	+ 142,000
From United Kingdom ...	47,000	112,000	+ 65,000
,, United States ...	108,000	184,000	+ 76,000
Electric fans and parts thereof—			
Total	214,000	399,000	+ 185,000
From United Kingdom ...	25,000	148,000	+ 123,000
,, Italy	54,000	61,000	+ 7,000
,, United States ...	135,000	183,000	+ 48,000
Electric wires and cables (rubber insulated)—			
Total	264,000	549,000	+ 285,000
From United Kingdom ...	207,000	498,000	+ 291,000
,, Japan	21,000	11,000	− 10,000
,, United States ...	34,000	39,000	+ 5,000
Ditto, insulations other than rubber—			
Total	139,000	417,000	+ 278,000
From United Kingdom ...	122,000	402,000	+ 280,000
,, United States ...	12,000	2,000	− 10,000
,, Japan	4,000	11,000	+ 7,000
Telegraph and telephone wires and cables—			
Total	*	31,000	—
From United Kingdom ...	—	28,000	—
,, United States ...	—	1,500	—
,, Japan	—	1,500	—
Bare copper wire (electrolytic)—			
Total	45,000	218,000	+ 173,000
From United Kingdom ...	18,000	64,000	+ 46,000
,, United States ...	9,000	106,000	+ 97,000
,, Japan	19,000	41,000	+ 22,000
Telegraph and telephone apparatus—			
Total	63,000	50,000	− 13,000
From United Kingdom ...	24,000	32,000	+ 8,000
,, Sweden	10,000	9,000	− 1,000
,, Japan	2,000	1,000	− 1,000
,, United States ...	27,000	8,000	+ 19,000
Electric glow lamps—			
Total	15,000	169,000	+ 154,000
From United Kingdom ...	7,500	104,000	+ 96,500
,, Holland	2,000	47,000	+ 45,000
,, Japan	1,000	3,000	+ 2,000
,, United States ...	4,000	8,000	+ 4,000
Electric lamps, other sorts—			
Total	90,000	73,000	− 17,000
From United Kingdom ...	42,000	35,000	− 7,000
,, Holland	18,000	23,000	+ 5,000
,, Japan	10,000	9,000	− 1,000
,, United States ...	19,000	5,000	− 14,000
Batteries—			
Total	31,000	28,000	− 3,000
From United Kingdom ...	6,000	11,000	+ 5,000
,, United States ...	25,000	17,000	− 8,000
Carbons, electric.—			
Total	*	8,000	—
From United Kingdom ...	—	7,000	—
,, United States	—	1,000	—
Accumulators.—			
Total	*	153,000	—
From United Kingdom ...	—	142,000	—
,, United States	—	11,000	—
Condensers, electric.—			
Total	*	5,000	—
Electric lighting accessories and fittings.—			
Total	*	314,000	—
From United Kingdom ...	—	277,000	—
,, United States	—	23,000	—
Electricity meters—			
Total	34,000	84,000	+ 50,000
From United Kingdom ...	25,000	71,000	+ 46,000
,, Switzerland	8,000	8,000	—
Electro-medical apparatus.—			
Total	*	7,000	—
Switchboards, other than telegraph and telephone—			
Total	61,000	55,000	− 6,000
From United Kingdom ...	32,000	36,000	+ 4,000
,, Japan	2,000	—	− 2,000
,, United States ...	27,000	19,000	− 8,000
Telegraphs, materials for construction and accessories—			
Total	3,000	9,000	+ 6,000
Telephones, materials for construction and accessories—			
Total	19,000	65,000	+ 46,000
From United Kingdom ...	12,000	42,000	+ 30,000
,, Sweden	4,000	12,000	+ 8,000
,, United States ...	2,000	19,000	+ 17,000

In addition to the foregoing, the following were imported as Government stores:—

Machinery and millwork—			
Total	447,000	856,000	+ 409,000
From United Kingdom ...	404,000	849,000	+ 445,000
Telegraph material—			
Total	579,000	419,000	− 160,000
From United Kingdom ...	578,000	417,000	− 161,000
Instruments and apparatus—			
Total	419,000	664,000	+ 245,000
From United Kingdom ...	416,000	655,000	+ 239,000
Other electrical goods and apparatus—			
Total	571,000	1,618,000	+1,047,000
From United Kingdom ...	279,000	1,026,000	+ 747,000
,, Holland	2,000	—	− 2,000
,, Italy	3,000	13,000	+ 10,000
,, Japan	19,000	45,000	+ 26,000
,, United States ...	264,000	513,000	+ 249,000

*Not separately recorded.

THE ENGINEERING EXHIBITION, CARDIFF.

Owing to the unprecedented success of the Engineering Exhibition that was opened at Cardiff on November 20th, under the auspices of the South Wales Institute of Engineers, and at the unanimous request of the exhibitors, the run of the show had to be extended and its closing date postponed from November 25th to 29th—a fact which reflects great credit on the quality of the exhibits and on the committee that was entrusted with the organisation of the enterprise. There was such a run on the space available that every part of the Drill Hall was taken, and many of the 70 exhibitors displayed samples of the products of more than one firm.

This year's enterprise was on a much more elaborate scale than that previously attempted; it is felt that the exhibition will now become a permanent institution, and that it will have considerable influence upon the industrial progress of South Wales, as the future prosperity of a country is, to a large extent, in the hands of engineers. Last year the Institute organised a fuel-saving exhibition at its headquarters in Cardiff, and it was the instantaneous success of that venture which inspired the attempt at bigger things. Many applications for stands had to be rejected, and promoters are very well satisfied at the success which has attended their efforts.

The electrical industry was strongly represented, and visitors were greatly interested in the large number of appliances on view. Naturally, with the rapid strides made in radio telephony, there was a big display of apparatus by many of the leading electrical firms, and amateur operators showed more than a passing interest in the latest sets put on the market.

The opening ceremony was performed by Mr. David E. Roberts, M.Inst.C.E., M.I.Mech.E., M.I.E.E. (president of the Institute), who mentioned that the whole of the electrical arrangements for the exhibition were efficiently carried out by Messrs. Page & Stibbs, electricians, Cardiff.

Among the exhibitors were The General Electric Co., Ltd., whose show of electrical plant took a wide range. General colliery switchgear was well represented by a 6,600-volt truck-type cubicle board, a pedestal draw-out type oil-switch panel, a "unit-type" ironclad switchboard (which is being supplied to one of the local collieries), also flame-proof switches, oil switches, cable boxes, and motor-control gear, both automatic and non-automatic. Another type of switchboard shown was a special panel for controlling small lighting sets, this being mounted on the generator of a lighting set. "Kingsway" miners' lamps were arranged on racks to illustrate the method of dealing with the necessary battery charging. Among other exhibits shown by the G.E.C. was a 30-h.p. steelworks motor for driving light rolls. "Gecophones" for broadcasting reception were also prominent, as well as numerous domestic devices.

Colliery signalling apparatus was to the fore, including the Peel-Connor mining telephone, the "Magnet" engine-room shaft indicator, also the "P.D." relay, an entirely new device, which operates with very small currents on both a.c. and d.c. circuits, and enables the bare-wire system of haulage road signals to be retained. A patent device is attached to show the amount of leakage in the signalling circuit, thereby giving due warning before the actual stoppage occurs.

Messrs. Ferguson, Pailin, Ltd., had a large number of exhibits, which included heavy-oil switches, as supplied to the Hydro-Electric Power Commission, Ontario. One of their chief exhibits, apart from their truck speciality and e.h.p. cubicle, was a mining-type, explosion-proof, oil switch, which has been developed to meet Home Office requirements for both fiery and non-fiery mines.

Messrs. Witty & Wyatt, Ltd., had a very good display, making a feature of Henley cables, colliery lighting fittings, switchgear, the Henley wiring system and street unit pillars, and Swedish General Electric, Ltd., a.c. and d.c. motors, &c.

On the stall adjoining the Sterling Telephone & Electric Co., Ltd., had a very interesting display of radio, telephone, and other apparatus, including the "Magnavox" loud-speaking instrument, receiving sets, the mine telephone with a throat transmitter, which is especially effective in noisy places, and also the Sterling shaft signalling systems, designed to prevent accidents in pit shafts.

Colliery officials were much interested in the safety lamps exhibited by Messrs. E. Thomas & Williams, Ltd., which included the new lamp for gas testing, not yet approved, but on the lines recommended by the Mines Committee. It is made in such a way that it feeds from the top, so that it can be placed near the roof, and thus any gas within three-eighths of an inch of the top would be detected, it is claimed. The firm's magnet relighter is self-contained, and can be adapted to relight while underground any type of flame safety lamp. Shot-firing magnetos, together with lighters, unlocking magnets, and accessories for use in the lamp room were also shown.

Messrs. Cooper & King, Ltd., exhibited a number of up-to-date appliances, including mining type switch pillars, oil break switch, cubicle switchboard, lighting transformer, and a gravity conveyor made by the W. & D. Conveyor Engineering Co., Ltd.

A new colliery and industrial-lighting system was exhibited by Messrs. Francis & Co., Ltd., the fittings being designed to meet the requirements of the memoranda relating to the use of electricity in mines. They embody entirely novel features greatly reducing the amount of work required to be done underground, and also simplifying the tracing and rectification of faults.

Messrs. Haslam & Stretton, Ltd., displayed a considerable quantity of electrical apparatus (made by various manufacturers), much of it for colliery use. These included the "Thor" tachograph.

The Relay Automatic Telephone Co., Ltd., attracted attention with its complete installation for an inter-departmental automatic telephone system, giving facilities for connection to 50 telephones. It comprised an automatic switchboard, power board, two sets of 24-volt batteries, and telephone instruments, all connected up for use.

Other exhibitors included the Cambridge & Paul Instrument Co., Ltd. (electrical indicators, recorders, &c.); Messrs. Ferranti, Ltd., Hollinwood (transformer); The Foster Instrument Co. (thermometers, electrical resistance type, &c.); Messrs. Twiss Electric Transmission, Ltd., and Messrs. Allen, West & Co. (electrical control and switchgear for mines and other purposes).

NORTH WALES AND CHESTER ELECTRICITY DISTRICT.

Commissioners' Second Inquiry.

The scheme for the re-organisation of the supply of electricity in the North Wales and Chester Electricity District, approved by the Electricity Commissioners, was the subject of a second inquiry in accordance with the provision of Section 5 (4) of the Electricity (Supply) Act, 1919, which opened at Llandudno on November 21st. A large number of local authorities were represented, including Llandudno, Conway, Penmaenmawr, Llanfairfechan, Carnarvonshire C.C., Chester, and Cwm, as well as the North Wales Power Co. Sir H. Haward presided, and the other Commissioners present were Messrs. H. Booth and A. Page, with Messrs. E. W. Hudson (legal advisor), and Mr. D. S. Cumberledge (secretary). The inquiry was the outcome of a previous one held in February of last year, and the resulting draft Order made by the Commissioners.

The Chester Corporation submitted that the Order was *ultra vires* and was undesirable, but the Commissioners had been advised that they were *intra vires*, said the chairman, who explained that the inquiry was not open for anyone to submit a fresh scheme, and the clauses were dealt with *seriatim*.

Sir Lynden Macassey, K.C., opened the case for the Chester Corporation, and in the course of a long reasoned argument submitted that Clause 7 of the draft Order, which provided that certain rights and obligations of the Joint Authority should be transferred by deed to the North Wales Power & Traction Co., was bad, and was not authorised under the Act.

The Order also extended the area, which could not possibly be done, as it had previously been fixed by Act of Parliament.

Elaborating the objection, Sir Lynden said the Power Co. was a joint stock company, and had borrowed money on the strength of the undertaking, and the memorandum of association would need altering, either in the Chancery Court, or by Act of Parliament. To put it bluntly, the Order was not worth the paper it was written on. An injunction could be made against the company, as the Commissioners had no power to alter the charges or vary the method of charging, as they had done. The powers given to the company explained the fears of the Corporation of Chester and other bodies being placed under the tender mercies of the North Wales Power Co. with regard to the points he had raised.

The Town Clerk of Cwm (Mr. Feltham) at this stage also made a formal protest against the proposal to transfer certain powers from the Joint Authority to the company, as in the 1919 Act no powers of delegation were mentioned.

Mr. C. S. Fame, of the Cheshire C.C., also registered a protest on the same lines.

Sir Lynden Macassey then raised the subject of questions as to the financial stability of the company to carry out its undertakings, and argued that it was desirable that this should be done in the interests of the public, who viewed the matter with apprehension.

Mr. Kennedy, for the Power Co., resisted the application that the private affairs of a company should be made public.

Mr. Wm. Cash, F.I.C.A., president of the Institute, of the firm of Stone & Co., London, then produced the balance sheets of the Aluminium Corporation for the years ending 1919, and for two years ending 1921, and gave his opinion that with the company's liabilities of £1,026,000 it would be difficult to borrow any more money, and that it would not be fair to saddle the public with so much dead capital.

The Chairman remarked that the Commissioners had considered the figures at the last inquiry and before the draft Order was made. There was nothing in the Order to compel Chester to take a bulk supply of electricity from the company if it did not desire to.

Sir Lynden Macassey: Chester can do much better for

itself if allowed to carry out its own salvation. It objects to being included in the district, and can show that it can get electricity at a cheaper rate than from the company. After the last inquiry it found that it could purchase the Queensferry station from the Government, and asked for powers to run it for itself, as it did not wish to be left in the lurch by the Power Co. Chester objected to districts in Wales having the first call on the electricity, and there existed a lively apprehension that if there was a drought the far-away districts would have to get what they could.

The Chairman said the Corporation of Chester never raised that question at the last inquiry. The Commissioners were satisfied that the water power resources would give the required amount of energy.

Mr. Amos Jones, Rhyl, asked would the Order exclude the right of any area like the Vale of Clwyd developing its own water resources?

The Chairman resplied that there would be no difficulty in that direction, as it was open for the Commissioners to alter the Order.

Mr. John Hall Rider, consulting engineer, gave evidence regarding the output of the Queensferry station and the approximate charges. The Chester Corporation had an agreement with the Government until 1924 for the supply of electricity for 3,000 kW at £4 10s. per kW per annum, and over 3,000 kW at £4 per kW per annum, plus actual cost of wages, fuel, oil, &c., and an additional 7½ per cent. on such cost. The Corporation had agreed to purchase the works for £54,000. On his recommendation it had agreed to spend an additional sum of £6,000 for two additional transformers and switchgear, and £1,500 for a pumping plant. There were three 1,500-kW and one 1,000-kW sets, and it was proposed to run at 4,000 kW and have one set as spare, and there was room for two more sets. The pressure was supplied at 33,000 volts, and was reduced to 6,600 and taken to the Crane Street station at Chester, and was there transformed and distributed partly as d.c. and a.c. in parallel with the energy generated at the Chester hydro-electric station, which cost practically nothing to produce after the standing charges had been paid off. From the figures supplied by the Power Co. he estimated that, on a consumption of 4,000,000 kWh per annum, and based on the price of coal at 14s. per ton, in 1923 the saving between the Corporation and Power Co.'s figures would be £3,562, or 23.8 per cent.; in 1924 £5,692 would be saved; in 1925 £8,166; in 1926 £11,133; and in 1927 £14,554, or 78 per cent., when the cost at Queensferry would be 0.754d., against 1.3444d. of the Power Co. The total cost per kWh would fall from 1.145d. in 1923 to 0.745d. in 1927. In his first report to the Corporation fuel was taken at 18s. 5d. He had now taken the figure at 14s., although the Corporation had now entered into large contracts at under 10s. per ton. He was of opinion that further economies could be effected at the Queensferry works.

Sir Lynden Macassey: The maximum price fixed under the Order to supply by the company was £6 per kW per annum, plus 0.75d. per kWh supplied.

Mr. Crosthwaite, on behalf of the North Wales colliery owners, said the latter did not wish to be represented on the Joint Authority if it was to involve them in any financial obligation.

On November 22nd the documents asked for on the previous day were handed to Mr. Kennedy, who proceeded to cross-examine Mr. Rider on the figures regarding the cost of production at Queensferry.

Mr. Rider stated that his figures were not for a full twelve months' working. In his opinion nothing would need to be spent on the works beyond the purchase price of £54,000; the £6,000 for the additional transformers and switchgear; and £1,500 for additional pumping plant.

Questioned by Sir Lynden Macassey, he reiterated that the figure he had given as to the cost of production could be regarded as a most conservative one. If coal doubled in price to the amount he had estimated the increase per kWh would amount to 0.16d., and in 1927 the saving would be £9,000 in favour of the Corporation against the price charged by the Power Co. It would not be economy to scrap the station at Queensferry if it was to cost the Chester Corporation more to buy from an outside source.

Mr. Kennedy: We are really indifferent whether Chester takes a supply from us or any other body. Our quotation was given in response to its invitation. We do not wish you to compel it to discard any station.

Sir Lynden Macassey: Chester can get a supply cheaper from that source than any other.

Mr. Rider was then subjected to questions by Mr. Page, one of the Commissioners, and replied that as regarded the economic life of the Queensferry station, it could be extended by putting in new boilers in a building already erected. This would also effect economy, as much heat was wasted under existing conditions. The conditions at Queensferry warranted the Chester Corporation buying the station. Recently he had saved the Corporation a sum of £100,000 owing to plant having come down in price. Personal control meant less charges than dual ownership; the proper thing to do would be to enlarge Queensferry. He had no objection to linking up with other works provided the combination did not increase the charge to Chester. The plant at Queensferry was not in a bad condition, but the lay-out was bad; heat was lost by a system of open hot wells.

The Chairman said that these questions had been necessary owing to the fact that the Commissioners had before them an application for sanction to a loan of £54,000 to buy the works, and he proceeded to put questions to Mr. Rider, who repeated that Queensferry was not an ideal station. The turbines were good, but the steaming efficiency was low owing to the boiler-house being faulty.

The Chairman: How would Chester be prejudicially affected by being included in this district?

Mr. Rider: I do not see any advantage in its being linked up by adding to a cheap supply a comparatively dear scheme.

The Chairman: You want home rule and all the advantages of being associated with other people.

Mr. Rider: The feeling is abroad that we shall be compelled to take a supply from the North Wales Power Co., and that is where the sting lies.

Mr. Sydney Ernest Britton, Chester Corporation Electrical Engineer, stated that the present price paid for coal by the Corporation was 9s. 8d. per ton.

Mr. Britton was cross-examined by Mr. Kennedy, on behalf of the North Wales Power Co., with regard to the present expenses at the Queensferry station, and the Chairman, interposing, remarked that what they wanted to get at was not whether the figures were accurate, but would the same system be carried out when the Chester Corporation had become the owner of the station.

Mr. Britton then replied that no further expense would be incurred on the management side, and the accountancy work would be done by the present staff at Chester. When they were producing 3,000,000 kWh at Queensferry full use was also made of the Dee hydro-electric works. The present assessment of Queensferry for rating purposes was £1,400, and the rates were 10s. in the £, and the Corporation was at present raising money at 4½ per cent.

Sir Lynden Macassey then addressed the Commissioners at great length, and submitted that there was no ground for the inclusion of Chester under the circumstances created as assuming Chester would be allowed to purchase the Queensferry station it would in any way, to quote Section 5 of the Electricity (Supply) Act, 1919, "conduce to the efficiency and economy of the supply of electricity" and to the convenience of administration. If Mr. Rider's evidence was accepted it was quite clear that as far as Chester was concerned there would be no advantage in including Chester within the area of supply of the Joint Electricity Authority, as it was apparent from the figures he had given that Chester, producing its own electricity at Queensferry, had an advantage over the purchase of energy from the North Wales Power Co. Under the final scheme a Joint Electricity Authority would have been appointed representative of the public authorities, but its responsibilities and powers had been handed over to a commercial company, and Chester objected to being subordinated to a commercial company, as was proposed in the Order.

The Chairman: There is nothing in the Order which suggests that.

Sir Lynden then reviewed the clauses in the Order, and contended that, if the water-power resources were fully developed, the Queensferry station would be closed down.

The Chairman said the Commissioners could not conceive that they would require the Queensferry station to be shut down, and they would not consent to it unless they were satisfied that there was an ample supply of electricity available for Chester; it might be some amendment of the phraseology of the Order was required to meet that particular point.

Sir Lynden then criticised the action of the Commissioners in transferring the powers of the Joint Electricity Authority to a commercial company.

The Chairman: That we absolutely deny. The powers of supply are transferred to the company, but the Joint Electricity Committee to be set up will generally supervise the supply throughout the whole district, and that was the object of setting it up.

Sir Lynden argued that because the North Wales Power Co. was responsible for the supply of energy there was no guarantee to the public that a supply would always be forthcoming, and concluded his address by remarking that no case had been made out for the retention of Chester as part of the area of the Joint Electricity Authority.

Alderman Pain, of the Cheshire County Council, and Mr. Feltham, Town Clerk of Crewe, also objected to being included in the area, and suggested that the area comprising the County Palatine of Chester should be established as a separate or sub-electricity district.

Mr. Tylor, on behalf of the London & N.W. Railway Co., said that it did not intend to depart from the position laid down at the last inquiry by Mr. Tyldesley Jones.

Mr. Amos Jones, Rhyl, looked at the agreement as unjust to the undertakers of North Wales, as simply securing for the Aluminium Corporation a vast fortune.

If ⅛d. per kWh was to be charged for ever, they would be debarred from bringing forward the Vale of Clwyd scheme for generating by water at a cheaper rate than was now proposed.

The Chairman: I think it will be quite open to bring up the Vale of Clwyd scheme at some future time and apply for a Special Order in connection with it.

One November 23rd Sir Lynden Macassey said that the Cheshire authorities had arranged that the Chester and Crewe Corporations, in collaboration with the other local authorities of the Cheshire area now included in the draft Order, should prepare a scheme under the Electricity Acts for supplying their districts with electricity, and submit it to the Commissioners on or before June 30th, 1923. Upon such a scheme taking effect that part of the Cheshire area now included in the draft Order—that was to say, in addition to Chester and not immediately excluded under Clause 1, that being Chester, would be transferred from the North Wales and Chester Electricity District, and such part, together with the part excluded under Clause 1, to form the district of the new scheme, adopting a course which was very frequently adopted under similar circumstances in the case of Parliamentary Bills. With regard to the railway companies, they would have the advantage of two separate supplies: one from the North Wales area, and the other from the new district, if it was formed, and in that case they would not have merely supplemental, but competitive, supplies.

The Chairman: The matter cannot be discussed here.

Representations were then made by Mr. Feltham, Town Clerk of Crewe, on the constitution of the Joint Authority, who described it as a Court of First Instance and the Commissioners as a Court of Appeal.

Commander Agglionby, representing the Ministry of Agriculture and Fisheries, made representations on behalf of the Dee Fishery Board.

Other representations put forward referred to the methods of election to the Joint Authority by various public bodies, several of which argued that the Joint Authority should be doubled in point of numbers, as under the Order the representation was inequitable.

Mr. Lawson Taylor, Town Clerk of Wrexham, said that his Council regarded the price of ¾d. per kWh for energy supplied by the Aluminium Corporation to the North Wales Power Co. as extravagant, and some protection was needed against a company which was managed by several officials who apparently acted for the other company. His Council not only suggested that the price be reduced, but that some provision should be made for a periodical revision of that charge, both ways, on the basis of the profits of the Aluminium Corporation.

The Chairman: If Chester's view as to the prospects of the Aluminium Corporation turned out to be right the consumers would suffer badly under the suggestion. The price has been fixed largely in relation to capital expenditure and it is a fair charge. There is no obligation on the part of the Power Co. to take the energy, and if later its works develop it would be open for it if it found it more profitable to give up that supply. The basis suggested could not be accepted.

Mr. Olmot Price, Wrexham Rural Council, also stated that the terms for energy quoted to them by the Power Co. were excessive, and Chester District Council suggested the price should be 25s. per quarter instead of £6 per annum per kW charge.

After luncheon, the Chairman said he had received a note from the solicitor to the Railway Companies in the following terms: "In accordance with the request of the Commissioners, I enclose copies of the clauses which it is suggested should be inserted in the scheme set out in the first schedule."

The chairman said the clauses were almost identical with Sections 36/40 of the North Wales Electric Power Co.'s Act of 1904.

Mr. Kennedy then addressed the Commissioners, and said the scheme had not been propounded by the Power Co., but by the Commissioners, and then proceeded to deal with Sir Lynden Macassey's criticism. With regard to the supply from the Aluminium Corporation's works, the company estimated that in three years' time it would be free of having to take any quantity of supplies from those works. The Power Co. was willing to consider any reasonable safeguards that the Commissioners could suggest in two ways for the supply of energy: (1) to secure the continuance of the supply so long as it was needed from the Aluminium Corporation to the Power Co.; (2) so far as they thought it desirable and it was possible to arrange the continuance by the Power Co. of the supply to the public. The Chester Corporation had taken a parochial view, and in order to enforce it, it was necessary to destroy the scheme. If Chester was of serious importance to the Power Co. he would figth its exclusion persistently. Chester was of little interest to the company, and he was instructed to say so.

The Chairman said that the Commissioners would in due course make an Order embodying their decisions.

American Mine Explosion.—An explosion of coal dust in the Woodward Coal Mine, near Birmingham, Alabama, killed eighty-three men and injured sixty more. Three empty cars on a slope two hundred yards above the mouth of the mine ran downwards, following the breaking of a cable, and broke the high-pressure electric wire. This ignited the coal-dust in the mine yard. The fire then caused an explosion in the mine.—*Daily Express.*

ELECTRIC LOCOMOTIVES.

The resumed discussion on a paper on "Electric Locomotives," by Sir Vincent L. Raven, K.B.E. (North-Eastern Railway)—the paper was abstracted in our issue of August 25th, 1922, p. 284—took place at a meeting of members of the Institution of Mechanical Engineers, in London, on November 17th. The paper advocated the use of one or two classes of shunting engines; one type of freight engine (the double-bogie type with easily accessible parts) and one type of express passenger engine (the quill-drive type). For dealing with suburban passenger traffic, however, the author advocated the adoption of the multiple-unit system. If such a state of affairs could be brought about, there was no doubt that immense economies could be effected.

Lieut.-Col. F. A. Cortez Leigh, R.E. (London & North-Western Railway) opened the resumed discussion. He referred to the figure of £103 for the average cost of repairs, inspection, preparing, cleaning, &c., per engine in 1921, for shunting locomotives in operation on the North-Eastern Railway of the double-bogie type, the daily service being about 18 hours, as being very low. He suggested that it would have been better to have taken an average figure over a number of years. Sir Vincent Raven had expressed the opinion that for the conditions applying to British railways the most suitable and satisfactory arrangement for an electric freight locomotive was the double-bogie design with two four-wheel bogies articulated together, each bogie containing two motors geared to the two axles without any form of coupling-rod transmission. It appeared to the speaker that in the case of freight locomotives requiring a continuous rating of some 2,000 h.p. there might be some difficulty in fixing the motors within the compass allowed by the bogie and framing. Why should they not have the motors fixed on the body of the engine, and adopt an arrangement similar to that on the Swiss locomotives? The author had suggested standardising only one class of electric locomotive for passenger traffic, but the speaker considered that there should be at least two. The methods of handling passenger traffic varied considerably on some railways, and it seemed to him that it would be more economical if a smaller type were standardised for suburban work, which was not capable of being dealt with by the ordinary motor-car system.

Mr. C. H. Merz (consulting engineer to the North-Eastern Railway) said that the electric motor had really, if a proper system of electric traction were adopted, been perfected; but the question was for what purpose did mechanical engineers wish electrical engineers to design the motors? Reliability had been proved provided a proper system were adopted. The question of the adoption of electric traction in this country at the present time was eminently a commercial one; in other countries other considerations frequently came into play very prominently which, in this country, were not likely to influence the matter, and the problem came down to one of £ s. d.; therefore it was very necessary to arrive at the simplest and cheapest form of locomotive. Sir Vincent had called attention to the fact, in connection with the freight locomotive, which he had suggested might be standardised in this country now, that that type of locomotive could not be so conveniently adopted, at any rate with single-phase traction, but he (Mr. Merz) hoped that that was not a question which need concern that meeting very much. The ease with which the bogies could be dropped and the necessary repairs carried out was obviously desirable, but the fact that he had recommended that type of locomotive was in effect a particular recommendation of the electric motor, because it might be argued as a justification for putting the motor in the cab that it was more easily got at. The motors had been very satisfactory; the original windings were still running on all the motors; the commutators had hardly been touched; the brushes had a remarkable life, and did not necessitate any particular dismantling of the locomotive to repair them; therefore, from the point of view of electrical engineers, it was very satisfactory that they had got so far as that with regard to the freight locomotive, which was, after all, the most important from the economic point of view. He did not think it would pay to electrify any line in this country for the express purpose of passenger traffic, and unless the freight traffic was large enough to justify electrification he did not think any line would be electrified. If such a locomotive as that advocated by Sir Vincent for freight work was good enough—and it had been shown that it was—the great advantage of standardising would be that it would enable electrical manufacturers to put down plant and to thoroughly arrange their shop methods for turning out a given equipment in large quantities. The cost would then be greatly reduced, and it would be possible to equip a line electrically at a materially lower cost than with steam locomotives. With regard to first cost, it could be shown that the cost would be less with electricity than with steam. He hoped that mechanical engineers would not be led astray by the numerous types of electric locomotive which existed; the reason for their existence was, to a great extent, the result of the supposed necessity in some other countries for making locomotives suitable for single-phase work.

Lieut.-Col. E. Kitson Clark said the public instinct had

decided upon electric locomotives. So far as small repairs were concerned electrical work required very little, but such was the fertile genius of electrical engineers that when the time came for heavy repairs they always had some "better" scheme on an entirely different principle, by the adoption of which a good deal of money could be "saved," not because the electrical material was worn out, but because electricians were always introducting "novel and splendid improvements," so that the "economy" to be gained by the adoption of "improvements" was very expensive. After describing the action of the teeth of the pinion and of the gear wheel when driving and when braking, he said it seemed desirable that there should be some sort of hardening of the pinion, in order that it should wear out at the same time as the wheel.

Major H. E. O'Brien (London & North-Western Railway) did not think the stage had yet been reached at which they should be prepared to say that everybody in Great Britain would be ready to accept a particular electric engine as standard. The passenger locomotive used by the North-Eastern Railway had a horse-power of 1,800; that was rather low, as compared with the tractive effort of some of the locomotives on the Continent, presumably because it was the intention to use it on a main line which had not very severe gradients. The severest section of the London & North-Western Railway, on which there was very heavy traffic, was probably that between Preston and Carlisle. To deal with the heavy passenger trains required on that section a considerably more powerful locomotive would be required than that designed for the North-Eastern Railway. The horse-power called for would be more of the order of 2,400. The suggested use of the same type of engine for all fast trains running considerable distances without stopping, and to equip a sufficient number of trains as multiple-unit trains without locomotives for local passenger services seemed to be the correct conclusion. It was improbable that 50 large locomotives would cost very much more than 75 smaller ones, but if they had a small locomotive for the average train, and double-headed the train when it was heavier, they would probably increase the number of locomotive units by 50 per cent. That inevitably meant increased inspection, repairs, and attaching and detaching the second engine, whereas one type of large locomotive could deal with any train, and the continuous use of electric locomotives (which was a most important factor in making a financial success of electric traction) would be greatly facilitated. What was the object of adopting six twin motors, the total voltage being 1,500? It would seem better to have a straight 1,500-volt motor, and 4-motor equipment.

Mr. J. Dalziel (electrical assistant, Rolling Stock Department, Midland Railway) explained that the Midland Railway authorities had, as far back as 1908, made up their minds that they could handle heavier traffic at better gradient speeds and give better line capacity with electric locomotives than with steam. There was on the Midland Railway a section which, of all sections of British railways, called for electrification. Centring on Chinley, the Midland main lines radiated to Manchester, Sheffield, and Derby, all passing over heavy gradients, and carrying a fairly dense traffic. On the 1 in 90 Peak Forest gradient, on to-day's figures, a train of 45 wagons could be taken up at 24 miles per hour with electric traction, as against 30 wagons at 8 miles per hour with steam. They could do their freight work with 43 electric locomotives in place of 100 steamers. At the same time they were not certain, at to-day's prices, that they could electrify to commercial advantage. To electrify the line from Derby to Manchester would cost 2¼ millions. Working that traffic with 115 electric locomotives instead of 251 steamers they could operate the line at £294,000 per annum, against £533,000 for steam, but (taking capital charges at 10 per cent.) they would still have a deficit. Of course, if manufacturers would bring down equipment and electric locomotive costs, the figures would change, but a further reduction of the price of locomotive coal would put the figures in the other direction. With regard to locomotive types, he agreed that for shunting and freight work the type of locomotive advocated by the author was adequate for the requirements. They could be built up to 1,500 h.p., and the cost at the present time would be about £9,000. With further price reductions, standardisation on the lines indicated by Mr. Merz, and with increased demand, they should see those locomotives at something like £5,000. Then there would be much greater possibilities of electrification. He did not see why the mechanical parts of such a locomotive should not be built at much less cost than the mechanical parts of the steam locomotive, apart from the boiler. The low centre of gravity and small wheel diameter were the principal objections to that type of engine, but so far as high centre of gravity had to be purchased at the cost of using a rod and jack shaft design it was not worth it; no rod design was necessary so long as Sir Vincent's design was available.

Mr. R. P. C. Sanderson (Baldwin Locomotive Works) said he had detailed reports of the conditions during the great railway strike in America last summer of every electrification, and, with one small exception (where the conditions were extraordinary) they all ran steadily throughout the strike, in spite of the shop difficulties, without failure, showing a degree of reliability that had never been reached by any steam traction yet. The one failure was on the Cascade Mountains, where the power available was insufficient for starting the trains, and where they had to use a steam engine to start them. As the result of the steam engine not being there the driver of the electric train undertook to start his train, and blew up the power house.

Sir. Vincent Raven undertook to reply to the discussion in writing.

ILLUMINATING ENGINEERING AND THE ARCHITECT.

An interesting departure took place at the meeting of the Royal Institute of British Architects on November 20th, when a paper on the above subject was read by Mr. L. M. Tye, Mr. Paul Waterhouse, president of the Institute, being in the chair.

Mr. Tye, in his introductory remarks, recalled the great changes that had recently taken place in artificial lighting, drawing attention particularly to the increased intrinsic brilliancy of illuminants, which made scientific methods of shading essential. Another advance had been the introduction of simple instruments of measuring illumination which had enabled the values of illumination required for various classes of service to be tentatively determined. A list of such values, illustrative of modern practice, was presented. Mr. Tye then explained some of the methods employed in calculating illumination and determining the spacing of lighting units in order to obtain uniform distribution. The lecture was illustrated with a large number of lantern slides, including photographs of typical modern installations. Attention was drawn to the importance of diffused reflection from walls and ceilings—a matter with which the architect was intimately concerned—and the desirability of the general scheme of decoration and the lighting being considered simultaneously.

One of the most important changes during recent years had been the greater recognition of the benefits of good lighting on the part of the public and the authorities—a result due largely to the educational work of the Illuminating Engineering Society, and the efforts of its hon. secretary, Mr. L. Gaster. Joint Committees formed by the Society had issued reports on school and library lighting, and a Home Office Departmental Committee had made a very comprehensive investigation of the subject of industrial lighting.

In conclusion, Mr. Tye referred to the great benefits that would be derived from fuller co-operation between the architect and the illuminating engineer. Consideration of the method of artificial lighting at an early stage in the preparation of plans made the installation of electric light much easier for the contractor. There were many points in which the architect and the lighting expert were jointly interested, such as the important part played by the nature of walls and ceilings in deciding the choice between direct, semi-indirect, and indirect lighting. In particular, artistic success in lighting demanded that the intentions and desires of the architect should be clearly indicated. In that connection Mr. Tye showed some views of interiors where recessed domes in the ceiling and other architectural embellishments afforded suitable points for the suspension of fittings, and where the lighting arrangements formed an essential element in the general design. Church-lighting provided many points for discussion, such as the desirability of hanging lighting fittings from the terminal points of arches—a convenient practice from the lighting standpoint, but one which some architects did not approve. Spectacular and flood-lighting, again, presented interesting problems, and there was no doubt that success in that direction was very largely dependent on co-operation between the architect and lighting expert.

A vote of thanks to the lecturer was moved by Sir John Herbert Parsons, president of the Illuminating Engineering Society, who, as an ophthalmic surgeon, could speak with experience of the benefits of co-operation between the Illuminating Engineering Society and the medical profession. He felt sure that similar good results would follow from co-operation between architects and lighting experts. In considering the effect of light on the eye, they had to survey the whole field of brightness, both by artificial light and the much greater illumination characteristic of daylight. Architects were accustomed to deal with access of daylight, but the study of artificial light was of equal importance.

Mr. W. R. Rawlings, in seconding the vote of thanks, likewise welcomed co-operation between the architect and the lighting expert, which would be a great aid to the electrical contractor.

Mr. L. Gaster, in opening the discussion, pointed out that illuminating engineering consisted in studying, not merely lamps and fittings, but their effect in the form of illumination. The impression received by the eye was necessarily determined by the manner in which surroundings were illuminated, and it was of great importance to the architect that the artificial light should be so arranged as to reveal his work and display it to the best advantage. One of the primary considerations was the avoidance of glare. He had many years ago advocated the screening of lamps in shop windows, and had been criticised by various shop-keepers for so doing. The methods of screening imposed during the war had accustomed the public

to the advantages of proper shading, and to-day concealed lighting was adopted by most of the leading stores in London. The design of shop frontages with a view to the convenient use of artificial lighting for purposes of advertising and spectacular display was one subject that might well receive more attention. He fully associated himself with what had been said regarding the need for co-operation between the architect and the illuminating engineer, who could learn much from each other, and he suggested that in future courses of instruction dealing with illumination should be included in the curriculum for architectural students.

Mr. C. H. Seager discussed at some length the use of light from the æsthetic standpoint, and the president, in closing the discussion, expressed his cordial sympathy with the general desire for co-operation in lighting matters.

NOTES FROM CANADA.

(From our Special Correspondent.)

The Provinces of Nova Scotia and New Brunswick have power commissions somewhat similar to the Hydro-Electric Power Commission of Ontario, although they have not been in existence so long. In connection with the work of the two first-named commissions two interesting events have occurred recently, one in each province.

In Nova Scotia the city of Halifax decided not long ago to obtain its electric power from the local company (*i.e.*, through private ownership), though the company will apparently purchase power from the water-power developed by the province. In New Brunswick the city of St. John has just decided, by a large majority in a popular vote, on purchase its own power directly from the Power Commission (*i.e.*, through public ownership) just as most municipalities in Ontario do. As these two provinces are in many respects very similar, it will be interesting to watch developments during the next few years. It is reported that the Shawinigan Water & Power Co. will start constructional work early next year on a power development at Gives Falls, which will involve an expenditure of ten or fifteen million dollars.

The *Canadian Engineer*, in an article by J. T. Johnston, the Assistant Director of the Dominion Water Power Branch of the Department of the Interior, recently published some very interesting data relating to the water-power situation in the St. Lawrence region.

On the assumption that the rate of growth of water-power development within 300 miles of the St. Lawrence River at the Long Sault Rapids during the past 15 years will be continued into the future, and this is said to be a conservative assumption, the development in h.p. up to the year 1940 will be as follows: 1922, 2,100,000; 1925, 2,350,000; 1930, 2,875,000; 1935, 3,405,000; 1940, 3,935,000. The rate of increase of water-power development for the past 15 years has been 104,000 h.p. per year. There are, within the area specified, no less than 464 water-power sites, capable of yielding 9,348,269 h.p. of 24-hour power at 80 per cent. efficiency, dependable for at least six months of each year, irrespective of betterments from storage; ten of these sites are each of 100,000 h.p. or over, and their total amounts to more than 6,600,000 h.p. Other figures are:—

No. of sites.	H.p. per site.	Total h.p. of all sites.
119	499 or less	29,000
68	500— 999	48,650
169	1,000— 4,999	395,400
68	5,000—24,999	677,600
14	25,000—49,999	511,300
16	50,000—99,999	1,068,000

It has recently been reported that the Ontario Government has sanctioned the construction, by the Hydro-Electric Power Commission of Ontario, of 508 miles of rural lines, 228 miles of which is already in existence and the rest under construction; 6,000 additional rural consumers will be added to the 2,000 already taking power from the Commission.

It is perhaps not generally known in England that Canada exports a very considerable amount of hydro-electric energy to the United States. Figures issued not long ago by the Department of Trade and Commerce at Ottawa show that very nearly 30 per cent. of the energy generated is sold to the United States, 24 per cent. being generated either at Niagara Falls or on the St. Lawrence River.

A little while ago an account was given in the Electrical Review of some electric steam boilers which are being employed by the Laurentide Co. for utilising off-peak power, and it has recently been stated by one of the company's officials that about 5,000 tons of coal per month is being saved by means of these boilers.

"Underground" Publicity.—The Underground Company, in conjunction with the Brighter London Association, has issued an attractive pictorial card announcing the times of the last trains from West End stations to various outlying districts. At the top of the card appears an excellent view of Piccadilly Circus and its electric signs.

LEGAL.

German Electric Vacuum Cleaners.

In the Mayor's and City of London Court, on November 23rd, an action was brought by James H. Brown & Co., Ltd., foreign bankers and dealers in exchange, St. Stephens Chambers, Telegraph Street, E.C., against Margands, Ltd., 24, Holborn, for £27 17s. 5d. as damages for breach of contract.

Mr. J. Douglas Young, plaintiffs' counsel, said that the defendants were carrying on a dental business at Brighton. In September Mr. Margands, who owned the defendants' business, called on the plaintiffs and asked them to help finance him in buying a German factory which made dental chairs. Two days later he said he wanted to buy 500,000 German marks, and plaintiffs put through the deal at 6,900 to the £. They gave him a contract form confirming the deal, and he paid £14, which was a 20 per cent. deposit. The marks were to be delivered in 90 days, which was usual. Defendant's cheque was stopped and Margands said he would be unable to carry through the deal. Marks were a very fluctuating commodity, and plaintiffs offered to buy them back at the current price, but defendants refused, saying they would fight. Plaintiffs then re-sold them at 11,200 to the £ and the present claim was for the loss incurred.

Mr. Ames, plaintiffs' secretary, said that marks were appreciating in value at the time, and when German goods were bought it was good business to buy marks the same day. They had the marks in stock.

Assistant-Judge Shewell Cooper: One may now talk of marks as if they were grocery.

Defendant said it was distinctly understood that the plaintiffs were not to buy the marks for him until his cheque had been cleared. He bought sixty electric vacuum cleaners in Leipsic at £15, which would be 75,000 marks. After he had paid his deposit he found marks were much lower than plaintiffs had quoted and he repudiated the transaction. The vacuum cleaners had not yet been delivered. The Government was encouraging people to trade with Germany because of the reparation duty.

Assistant-Judge Shewell Cooper said that the defendant's version was incredible to him. He was satisfied with the plaintiffs' case, and he found for them with costs.

Workmen's Compensation Claim.

In the Mayor's and City of London Court, on Monday, Walter Mansfield, contractor's engine driver, 62, Priory Road, East Ham, claimed against John Shelbourne & Co., pile drivers and contractors, 29, Mark Lane, E.C., damages under the Workmen's Compensation Act, for injuries that befell him on September 16th at the wharf of the Western Electric Cable Works, North Woolwich, while engaged in lifting a "traveller," which had to be affixed to a pile. The little finger of his left hand was crushed and his right hand and wrist were crushed between the traveller and the wharf. His wages had been £3 15s. per week. He claimed 35s. a week during incapacity. Defendants had paid ten guineas into Court which plaintiff said he would accept in full satisfaction of the claim. Assistant-Judge Shewell Cooper approved.

Colliery Company and Officials Fined.

Aberavon magistrates on Monday imposed a fine of £10 upon the Glynconwg Colliery Co., £4 upon Gwilym Rowlands, manager, and £1 upon Thomas Thomas, electrician to the company, for a breach of the Mines Regulations by having 6,000 yards unarmoured electric cable in their workings on July 20th, and the officials for failing to have live contacts of the electric plant suitably protected and certain metal pipes near machinery properly earthed.

Mr. Windsor Williams, prosecuting for the Home Office, said the omissions rendered the colliery premises liable to a sudden outbreak of fire. There had been considerable correspondence, and the Home Office had given the colliery directorate every opportunity of remedying matters.

Mr. Thomas A. B. Horsley, a Mines Department Inspector, said that when he visited the colliery the manager and electrician were very frank about the unarmoured cable.

Mr. Kirkhouse Jenkins, defending, said that a flood at the colliery involved a temporary breach of regulations. They were now being complied with.

Pathé's Film of Kearney Railway.—The film of the Kearney high-speed railway recently taken by Messrs. Pathés Frères for inclusion in their weekly pictorial was released for exhibition on November 20th. Mr. E. W. Chalmers Kearney is shown subjecting one of his model cars to tests and, in addition to Pathé's production, a more lengthy film embodying the plans and particulars of the proposed Kearney high-speed tube in Sydney is to be shown every day for some weeks at the Australia House kinema.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Device to Prevent Back Running of Tramcars.

Mr. P. Priestley, A.M.I.E.E., general manager of the Liverpool Corporation Tramways, has patented an alteration of, and addition to the present type of tramcar controller, which ensure that when a car is travelling up a gradient and for any reason the current fails or the trolley leaves the wire and the car consequently starts to run back, the motorman has only to throw the controller handle to the off position, with the result that the current generated by the motors operates a special sanding device on the rear wheels which makes the sanding and braking independent of the human element. This does not interfere with the automatic sanding device, which can be used in connection with the rheostatic brake when a car is descending a gradient in the ordinary manner. One of the great troubles which tramway managers have always had has been that of cars running backwards down a gradient, and some of the worst accidents have happened in this way. It is claimed that this device will make such an occurrence practically impossible. The motorman has not to look for a special sand tramp, or rely upon the conductor to be on the rear platform in order to operate the sanding arrangement.

Radio Power Generators.

Two examples of radio broadcasting power generating sets which Messrs. Newton Brothers (Derby), Ltd., Market Place, Derby, have recently designed, manufactured, and delivered for use in the Manchester broadcasting station, are illustrated in fig. 1. The firm has for some considerable time specialised in the design and manufacture of dynamo-electric machinery for radio purposes, having secured excellent results both by way of characteristics related to purity and quality of tone in radio telephony, as well as maximum output per unit weight of the machines. In order to obtain purity and quality of tone in radio telephony, it is claimed to be absolutely imperative that a source of h.p. supply to the valve anodes should be provided with the following characteristics:—(*a*) Direct or unidirectional current; (*b*) unvarying potential under load; (*c*) freedom from slot and commutator ripples; (*d*) potential under instantaneous control to facilitate tuning, valve conditions, and aerial current required.

It is claimed that the d.c. h.p. generators illustrated fulfil these conditions. Fitted with single commutators specially designed, they are capable of giving a steady voltage of from 2,000 to 5,000 volts by shunt regulation when running at constant speed, and by special field and armature construction, slot and commutator ripple is practically eliminated. The machines were tested at 6,000 volts at full-load current on a steady load as for r.t., and on a Morse key w.t. load, and are guaranteed against flashover or sparking under all working conditions. The motors are the firm's standard three-phase

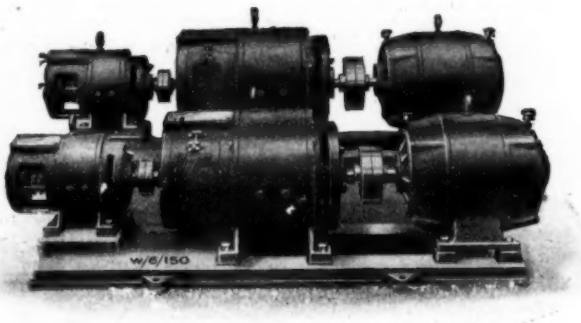

Fig. 1.—Newton Radio Power Generators.

induction machines for 50-cycle supply, and the small exciters are wound to give, in addition to the current for field excitation, direct current at a suitable pressure for charging accumulators and heating valve filaments.

Both sets are fitted with ball bearings, and were manufactured for the Radio Communication Co., Ltd., specially for the Manchester radio broadcasting station; they exhibit the simplest method of utilising three-phase, 50-cycle, a.c. for radio telephony.

In conclusion, it may be stated that both machines were designed, manufactured, and delivered within the extraordinarily short period of two weeks, and it should be remembered that machinery for radio purposes varies within such wide limits with regard to output, voltage, and special characteristics that it is not possible to stock it, it being necessary to design and manufacture for requirements as they arise.

The "Utility" Multiple Toaster.

The multiple toaster illustrated in fig. 2, which is made by Electrical Utilities, Ltd., 1-3, Shelgate Road, S.W.11, is an appliance which should prove extremely useful in restaurants, canteens, &c. It is made in three standard sizes with eight, six, or four heating elements, capable of dealing with seven, five, or three pieces of toast. The holders are suitable for slices measuring 5½ in. x 4½ in. x ¾ in., and are pivoted at one corner. By means of a small lever fitted with a heat-

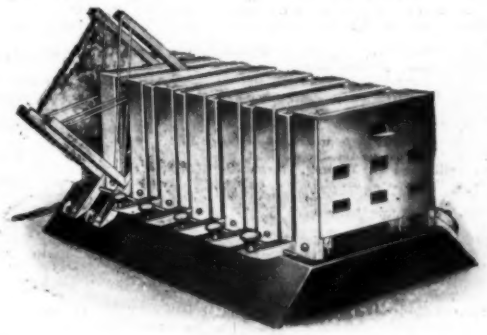

Fig. 2.—The "Utility" Multiple Toaster.

insulated handle each toast-holder can be swung out for the insertion or withdrawal of the bread. The largest size has four, and the next size three, and the smallest two switches, each controlling two elements. The elements take approximately 440 W each, and consist of nickel-chromium wire supported in eyeletted mica strips with polished aluminium frames. The base is of black-enamelled or polished nickel-plated steel, and encloses all wiring, presenting a neat exterior.

The "Paragon" Lamp Lock.

We have received from Mr. F. E. S. Davies, 44, Bloemfontein Road, W.12, a sample of a new form of lamplock which he has designed. It consists of an external collar with a lower rim and a small slot to admit the lamp pins. Inside this is a collar and a spring. This internal collar possesses projections which engage in slots in the exterior case. The method of fixing is as follows: the lamp cap is

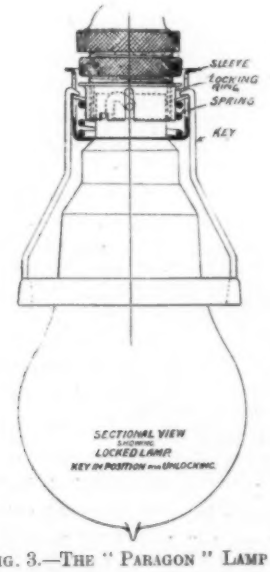

Fig. 3.—The "Paragon" Lamp Lock.

pushed through the bottom of the lock and the pins slide into the slots of the locking ring. The lamp is then pushed into the holder and the action of the spring automatically locks the lamp in position. The lamp lock is removed by means of a special key, which engages with the projections of the inner ring and pulls this down against the spring. The key is held tightly, and the lamp, lock, and key all come away from the holder by releasing the lamp from the bayonet socket. The illustration (fig. 3) shows a sectional view of the arrangement when locked, with the key in position for unlocking.

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Patent Agents, 285, High Holborn, London, W.C. 1.

30,803. "Cartons, &c., for electric lamps." R. Hunt. November 10th.
30,806. "Wireless receiving apparatus." B. G. Calver. November 10th.
30,808. "Transmitters for electric recording and signalling systems." A. B. Buckley, W. Clark, and J. S. Wilson. November 10th.
30,810. "Means for using wireless receiver with gramophone, &c." C. Dibdin. November 10th.
30,814. "Talking-machine amplifiers." M. Strickland and Stucoid Plastic Art Co. November 10th.
30,831. "Electric ship propulsion." British Thomson-Houston Co., Ltd., and G. O. Watson. November 10th.
30,838. "Electric cables." B. Davies and Eastern Telegraph Co., Ltd. November 10th.
30,833. "Electrical transmitting and receiving apparatus for telegraphy, &c." S. Lindet. November 10th. (France, December 1st, 1921.)
30,845. "Electric lighting systems for vehicles." T. C. Coles. November 10th.
30,904. "Receiving signals." Marconi's Wireless Telegraph Co., Ltd. November 11th. (United States, November 12th, 1921.)
30,922. "Electric generators for signalling." S. G. Frost. November 11th.
30,929. "Electric power transmission systems." A. M. Taylor. November 13th.
30,939. "Apparatus for heating forgings, &c., by electricity." Dagobert, Timar & Co., and E. Schroder. November 13th.
30,957. "Apparatus for reception of wireless telegraphy, &c." G. Derham, J. W. Hall, and G. Tipping. November 13th.
30,962. "Wireless installations on vehicles." N. H. Clough. November 13th.
30,979. "Galvanic batteries." J. L. Morris, A. H. Railing, and J. T. Ross. November 13th.
30,987. "Electric controllers." Metropolitan-Vickers Electrical Co., Ltd. (Westinghouse Electric & Manufacturing Co. partly) and N. E. North. November 13th.
30,988. "Automatic electric railway systems." A. D. Ferguson and Metropolitan-Vickers Electrical Co., Ltd. November 13th.
30,990. "Automatic electric motor-control systems." A. D. Ferguson and Metropolitan-Vickers Electrical Co., Ltd. November 13th.
30,993. "Receiving apparatus for wireless, &c., signalling." J. B. Bolitho. November 13th.
31,013. "Automatic interrupters for electric heating apparatus." R. Andersson. November 13th. (Sweden, November 28th, 1921.)
31,016. "Trough reflectors." British Thomson-Houston Co., Ltd., and H. C. Wheat. November 13th.
31,028. "Manufacture of electric glow lamp bulbs." A. M. Monnier. November 13th. (France, June 29th.)
31,045. "Continuously-variable resistance." H. D'O. Mantle. November 14th.
31,075. "Separator plates for electric accumulators." P. J. Gruber and Tudor Accumulator Co., Ltd. November 14th.
31,079. "Headlights of motor vehicles." C. W. Done and R. H. Newill. November 14th.
31,080. "Selectors for distributing electric energy." T. E. R. Phillips. November 14th.
31,089. "Rectifying devices." A. R. Angus. November 14th.
31,090. "Rectifying devices." A. R. Angus. November 14th.
31,096. "Electric measuring instruments." W. K. Barker and S. G. Jones. November 14th.
31,102. "Boxes for electric accumulators, &c." W. R. Edwards. November 14th.
31,111. "Device for preventing or extinguishing electric arcs, &c." J. von Clossman and H. Halberstadt. November 14th.
31,114. "Electric traction." G. H. Fletcher and Metropolitan-Vickers Electrical Co., Ltd. November 14th.
31,117. "Wireless kinematographs, gramophones, &c." J. Hetherington. November 14th.
31,118. "Electron devices." British Thomson-Houston Co., Ltd. November 13th. (United States, November 15th, 1921.)
31,119. "Metallic resistances." British Thomson-Houston Co., Ltd., and N. Laycock. November 14th.
31,120. "Ignition systems for internal-combustion engines." British Thomson-Houston Co., Ltd., E. G. Parrott, and A. P. Young. November 14th.
31,145. "Electric switches." Akt. Ges. Brown, Boveri et Cie. November 14th. (Germany, December 14th, 1921.)
31,150. "Electric burners for singeing textile threads." Soc. Anon. Electro-Textile. November 14th. (France, October 2nd.)
31,168. "Galvanic baths." J. Hess and F. Kitchener. November 14th.
31,178. "Electric resistances, grid leaks, &c." G. Marshman. November 15th.
31,196. "Thermionic valves for wireless telegraphy, &c." A. Dinsley. November 15th.
31,207. "Cleaning tool for sparking plugs, &c." L. H. Stevens. November 15th.
31,212. "Flashlight for mines, &c." R. Allen. November 15th.
31,214. "Vacuum tubes." E. Y. Robinson. November 15th.
31,230. "Automatic electric circuit breakers." J. von Clossmann and H. Halberstadt. November 15th.
31,240. "Electric impulse distributing systems." Western Electric Co., Ltd. November 15th. (United States, January 13th.)
31,251. "Oil-immersed electric switchgear." British Thomson-Houston Co., Ltd., and H. Trencham. November 15th.
31,252. "Electron-discharge devices." British Thomson-Houston Co., Ltd. November 15th. (United States, November 15th, 1921.)
31,253. "Enclosed electric switchgear." British Thomson-Houston Co., Ltd., and H. Trencham. November 15th.
31,264. "Apparatus for radiology, &c." F. Holweck. November 15th. (France, November 15th, 1921.)
31,273. "Electric insulators." British Thomson-Houston Co., Ltd., and J. H. Butcher. November 16th.
31,274. "Electric power transmission systems." A. M. Taylor. November 16th.
31,286. "Sanding devices for electrically-propelled vehicles." P. Priestly. November 16th.
31,292. "Electric lamps, &c." J. L. Knox. November 16th.
31,349. "Headlight with electric and acetylene lighting." M. H. H. M. Chaumont. November 16th. (Belgium, November 17th, 1921.)
31,357. "Lead storage batteries." F. Jacobacci. November 16th.
31,360. "Electric signalling over cables." B. Davies and Eastern Telegraph Co., Ltd. November 16th.
31,361. "Temperature indicators." British Thomson-Houston Co., Ltd. (International General Electric Co., Inc.). November 16th.
31,362. "Protective apparatus, &c., for alternating electric current distribution." British Thomson-Houston Co., Ltd., and A. S. FitzGerald. November 16th.
31,395. "Thermostatic relay." P. V. Castell-Evans and J. M. Longe. November 17th.
31,430. "Electrodes." H. Baumgartner. November 17th. (Germany, May 13th.)
31,452. "Electric motors." M. W. Woods. November 17th.
31,455. "Vacuum tubes." E. Y. Robinson. November 17th.
31,463. "Electrical insulation of metallic strips, &c., whereby uniform mechanical separation is ensured." W. B. Sayers. November 17th.
31,466. "Electric inductance coils, &c." H. P. T. Lefroy. November 17th.
31,481. "Electric couplings." L. Krieger. November 17th. (France, November 18th, 1921.)
31,482. "Ignition apparatus." British Thomson-Houston Co., Ltd., and A. P. Young. November 17th.
31,483. "Electric heating devices." British Thomson-Houston Co., Ltd. (International General Electric Co., Inc.). November 17th.
31,486. "Telephone systems." B. B. Johnson and Relay Automatic Telephone Co., Ltd. November 17th.
31,487. "Telephone exchanges." B. B. Johnson and Relay Automatic Telephone Co., Ltd. November 17th.
31,488. "Telephone exchanges." B. B. Johnson and Relay Automatic Telephone Co., Ltd. November 17th.
31,489. "Telephone exchange systems." B. B. Johnson and Relay Automatic Telephone Co., Ltd. November 17th.
31,490. "Telephone systems." B. B. Johnson and Relay Automatic Telephone Co., Ltd. November 17th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1921.

11,682. "Protective devices for electric circuits." British Thomson-Houston Co., Ltd., and A. S. Fitzgerald. April 22nd, 1921. (188,001.)
12,502. "Electric meters." F. Holden, and Measurement, Ltd. May 2nd, 1921. (188,066.)
13,304. "Electrically-propelled ships." R. MacGregor. March 13th, 1922. (188,009.)
15,440. "Radio telegraphic transmitting stations." J. Bethenod. September 14th, 1920. (169,143.)
17,621. "Electrically-braking motor vehicles." P. F. Smith and P. V. Powell. June 28th, 1921. (188,021.)
17,960. "Telephone systems." Creed & Co., Ltd., and T. Lenaghan. July 1st, 1921. (188,024.)
19,665. "Electric accumulators." A. Pouchain. July 21st, 1921. (Addition to 170,618.) (188,027.)
19,734. "Electric switching devices of the cartridge-fuse type." A. De Gessier. July 22nd, 1921. (Convention date not granted.) (167,167.)
19,996. "Devices or apparatus for avoiding the glare or dazzle emanating from lamps, such as the electric lamps of automobiles." Butlers, Ltd., and A. Reeves. July 26th, 1921. (Cognate applications 25,178/21 and 29,352/21.) (188,035.)
20,202. "Electrically-illuminated advertising devices." H. S. Coleman. July 27th, 1921. (188,039.)
20,230. "Girder or beam attachment for electrical conduits, gas or water pipes, and the like." H. Laycock and E. Laycock. July 28th, 1921. (188,041.)
20,254. "Process and apparatus for electrolytically oxidising or reducing substances." C. J. Thatcher. July 28th, 1921. (188,042.)
20,299. "Control for dynamo-electric machines." British Thomson-Houston Co., Ltd. (General Electric Co.). July 28th, 1921. (188,048.)
20,334. "Construction of ceramic vessels with electric heating." A. Steinhardt. July 28th, 1921. (188,050.)
20,335. "Reflectors." H. Sefton-Jones (W. A. Dorey). July 28th, 1921. (188,051.)
20,361. "Electric switches." F. B. Cox. July 29th, 1921. (188,053.)
20,395. "Electrolytic cell." C. J. Thatcher. July 29th, 1921. (188,056.)
20,405. "Headlights and other lamps for vehicles." A. Graves. July 29th, 1921. (188,057.)
20,504. "Electrode seal and support for mercury-vapour arc rectifiers of glass." E. Marschner. July 30th, 1921. (188,068.)
20,650. "Automatic safety locks for electrically-controlled lifts." W. H. Cozens. August 3rd, 1921. (188,076.)
20,868. "Wireless signalling systems." British Thomson-Houston Co., Ltd (General Electric Co.). August 5th, 1921. (Cognate applications 20,942/21 and 21,473/21.) (188,082.)
21,737. "Traffic-controlling apparatus for railways and the like." J. T. Roberts, P. W. Hardman, W. S. Roberts, and Railway Signal Co., Ltd August 16th, 1921. (188,097.)
22,380. "Electron-discharge devices." General Electric Co., Ltd., and B S Gossling. August 23rd, 1921. (188,108.)
22,870. "Electric light fittings with bowl shades or reflectors." H. C Pride. August 28th, 1921. (188,117.)
23,612. "Electric switches." British Thomson-Houston Co., Ltd. (Genera Electric Co.). September 5th, 1921. (188,131.)
24,062. "Portable electric heating apparatus with accumulation of heat." Kindlimann & Co. December 13th, 1920. (172,930.)
24,285. "Telephone exchange systems." Western Electric Co., Ltd (Western Electric Co., Inc.). September 13th, 1921. (188,138.)
24,650. "Electric switches." A. S. Cubitt. September 16th, 1921. (Cog rate application 16,450/22.) (188,144.)
24,980. "Sound-signalling apparatus." P. Haig. September 21st, 1921. (188,147.)
25,145. "Synchronous dynamo-electric machines." E. P. Hill and Metropolitan-Vickers Electrical Co., Ltd. September 22nd, 1921. (188,150.)
25,170. "Electric radiators." Soc. Générale "Le Prométhée." September 22nd, 1921. (169,454.)
26,427. "Portable electric battery lamps." T. Rombach. October 6th, 1921. (188,161.)
27,119. "Electrical connection." P. Tracy. October 13th, 1921. (188,172.)
27,228. "Locking switches for magneto circuits of vehicles driven by internal-combustion engines." J. E. Hailstone. October 14th, 1921. (188,175.)
28,144. "Electric fuses." J. H. Tucker & Co., Ltd., and W. J. Line. October 24th, 1921. (188,189.)
28,160. "Wall and like plugs for electric lighting and power circuits." L. J. Lepine and F. D. Denner. October 24th, 1921. (188,190.)
29,756. "Magazine fuse plugs." Jensen Trading Co., Ltd., Aktieselskab, and P. G. U. Buch. November 8th, 1921. (188,205.)
31,083. "Electric heat radiators." A. J. Ellis and J. C. Vines. November 21st, 1921. (188,219.)
32,282. "Incandescent electric lamp holders." J. R. Sibils. December 8th, 1921. (188,236.)

1922.

2,242. "Electric water heaters." Z. Trotzer. November 24th, 1920 (174,609.)
2,935. "Electric switches." Cable Accessories Co., Ltd., F. H. Reeves, and P. W. Davis. February 1st, 1922. (188,268.)
7,483. "Inert cells." C. S. Mummery and Ever-Ready Co. (Great Britain) Ltd. March 14th, 1922. (188,280.)
11,475. "Combined electric couplings and switches." O. Ellinger. April 23rd, 1921. (178,866.)
13,342. "Loaded signalling conductors." Western Electric Co., Ltd. (Western Electric Co., Inc.). May 11th, 1922. (188,287.)
17,695. "Apparatus for applying curative treatment with a radio-active substance." A. Muguet. June 29th, 1921. (182,469.)
18,935. "Sound amplifiers for sound-reproducing machines." A. Benoit, J. L. Mathieu, and H. H. Duchesne. April 27th, 1921. (Divided application on 188,003.) (188,292.)
20,443. "Insulation of electric cables." C. J. Beaver, A. W. Claremont, and L. B. Claremont (legal representatives of E. A. Claremont (deceased)), and W. T. Glover & Co., Ltd. July 26th, 1922. (Addition to 182,510.) (188,298.)